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HOW TO LAY STEEL ROOFING





HOW TO LAY STEEL ROOFING



A PRACTICAL HANDBOOK
EXPLAINING AND DEMONSTRATING PICTORIALLY
THE CORRECT METHODS FOR LAYING
SHEET STEEL ROOFING

Presented by
REPUBLIC STEEL CORPORATION
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HOW TO LAY STEEL ROOFING

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USES STEEL ROOFING TO PREVENT SPREAD OF FIRE

THE Bureau of Standards, U. S. Department of Commerce, burned down the building shown at left and located in Washington, D. C., for the purpose of testing out steel safes. To reduce the hazard to surrounding buildings from flying sparks and fire brands which could be expected to issue from the fire as soon as a hole was burned through the old inflammable roof, the Bureau of Standards had a galvanized roof applied over the old roof.

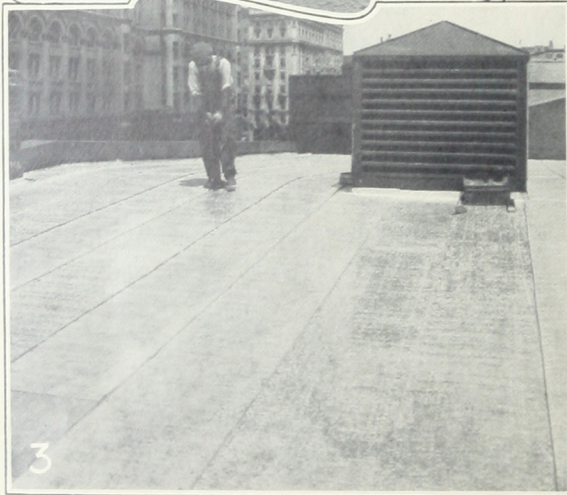
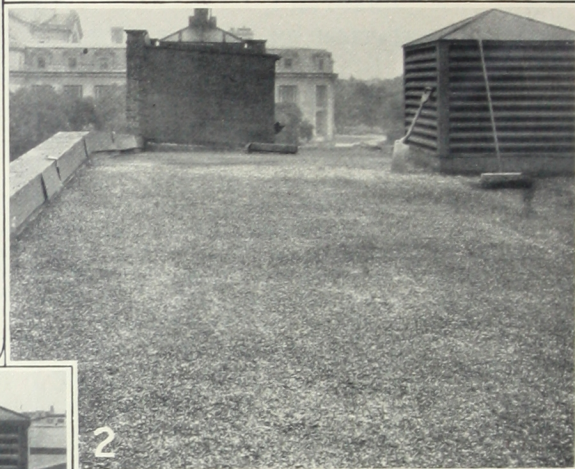
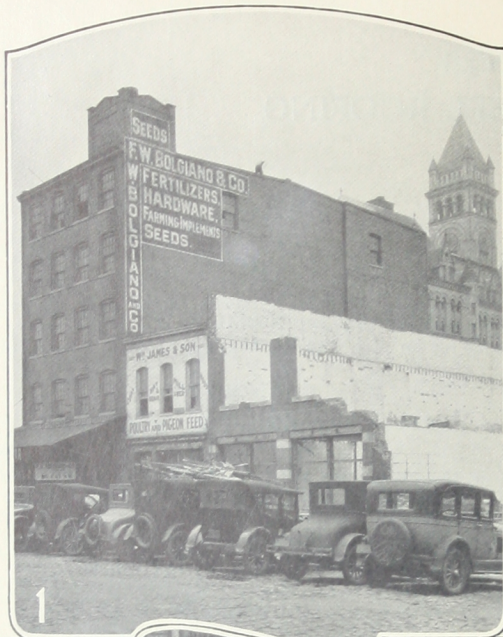


FIGURE 1 shows the building before the fire, Fig. 2 the old inflammable roof; Fig. 3, the new steel roof being applied, and Fig. 4, the fire under good headway. Note in Fig. 4 the absence of flames above the roof.



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PREFACE

How to Lay Steel Roofing

THE day of the single-purpose roof—a covering that provides nothing more than shelter—is gone. Fire losses are costing American home owners millions of dollars every year. Lightning is responsible for one-eighth of this loss in rural communities. Hundreds of lives each year are sacrificed to both of these destroyers.

The triple-purpose roof of Galvanized Sheet Steel has come to combat these enemies of civilization. It is called a triple-purpose roof because it does a three-fold job in providing:

1. *Secure shelter.*
2. *Protection against lightning.*
3. *Protection against other fire hazards.*

At the same time it costs no more per year of service than an ordinary roof.

Because of the rapid increase in the use of Galvanized Sheet Steel for roofing, this book is published to insure proper application of the material. The following pages explain in detail just what types of Sheet Steel roofing are best suited to any particular roof, how to measure a roof and how to order the proper amount of steel required for any specific job. Step-by-step construction pictures describe how to correctly apply it.

To those who plan to do their own work, it is recommended that Chapters 1, 6, 7 and 8 be studied before definitely deciding just what type of steel roofing to use and before placing an order. By following this recommendation it will be possible for the layman to include everything he needs—steel sheets, ridge finish, hip finish, formed valley, eaves trough, conductor pipe, fittings, ventilators, nails and washers—all in his initial order.

Republic Steel Corporation, through its many dealers scattered over the country from coast to coast, offers three different types of sheet metal for roofing purposes. The first of these is galvanized steel—a material widely used under ordinary service conditions. However, where atmospheric conditions are conducive to rust and corrosion, another type, copper-bearing steel, frequently is a better choice.

The third type of sheet metal has proved to be the most satisfactory material to use where the rust hazard is great. This is Toncan Iron, an exclusive product of Republic Steel Corporation. As an alloy of a refined open hearth iron, copper and molybdenum, Toncan Iron possesses extremely high rust-resisting properties. Although its cost is slightly higher than that of some other materials, roofing products made from Toncan Iron will pay for themselves over a period of time because of their added years of service in severe corrosive conditions.

The Agricultural Extension Bureau of Republic recommends that careful thought be given rust-promoting conditions before selecting the one of these three types of sheet metal roofing materials which is best suited to the particular job.

As this book goes to press the Bureau is especially anxious to bring to your attention the new "Triple Drain Channel Roofing" which, added to V-Crimp, Pressed Standing Seam, Corrugated Roofing and many roofing accessories, completes Republic Steel Corporation's line of roofing products. For details on Triple Drain, see pages 38a and 38b.

Further information upon any subjects discussed in this book is available upon request.



THE AGE OF STEEL ON THE FARM

IT was only natural that the unusual merits of sheet steel—long recognized and widely incorporated in commercial and industrial building—should ultimately be made available in the agricultural field. So today are found innumerable farms with every building roofed and sided with steel, many of them with steel frame work.

Modern houses, barns, sheds, silos, corn cribs, shelters, brooders and other miscellaneous farm buildings are now constructed better and more permanently of this fire and lightning protective material which, when used in adequate gauge, economically provides such unusual durability and long life.

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CHAPTER I

General Information on Steel Roofing

Quality of Steel Roofing to Use

THE thickness of either sheet iron or steel is called its gauge. The larger the number of the gauge, the thinner the sheet, and the less it weighs per square foot, whether it be galvanized iron or steel. For instance, a No. 16 gauge galvanized sheet is about 1/16 of an inch thick and weighs a trifle more than 2½ pounds per square foot, while a No. 28 gauge galvanized sheet is only 1/64 of an inch thick and weighs only ¾ of a pound per square foot.

The Agricultural Extension Bureau recommends that under no circumstances should galvanized sheets lighter than No. 28 gauge be used for roofing purposes in the most favorable climates. In damp climates No. 26 gauge or heavier is recommended. This same recommendation with regard to No. 28 gauge roofing is made by the Bureau of Standards, United States Department of Commerce through its Division of Simplified Practice.

Lighter gauges are found to be unsatisfactory for roofing purposes. In other words, the material is too thin to provide the long life desired in a roof, particularly where climate is severe. When very thin material is used for roofing in severe climates, it frequently reflects discredit to sheet steel roofing in general.

Just as there are windfalls in the apple market, so occasionally are there slightly imperfect or blemished sheets of galvanized steel for sale in the steel market. These are termed "seconds." While some of these seconds are satisfactory in those manufacturing processes where the blemished parts can be culled out, they should never be used for roofing or siding. Always insist on "prime" sheets.

Prime sheets should be free from all surface blemishes and mechanical imperfections, accurately formed, and of honest weight and measure.

Let us repeat, *the smaller the number of the gauge the thicker the steel.* Like sole leather, the

thicker the steel, the longer it will last.

The largest part of the cost of any roof is the cost of labor, whether you do the work yourself or hire it done. This labor cost is practically the same whether you use No. 28 gauge or No. 24 gauge steel. The few extra dollars required for the thicker and heavier material will be returned to you many times over in trouble-free service.

Types of Steel Roofing

Of the various types of steel roofing, four are in formed individual sheets and are known as Triple Drain, Corrugated, V-Crimp and Pressed Standing Seam. Steel roofing in the form of strips 50 feet or more in length is used for Self-Capping Roll Roofing and Double Standing Seam Roll Roofing. Of these six types, five are shown on pages 10 and 11. Triple Drain is illustrated on page 38b.

Triple Drain, the newest type of steel roofing, is described in detail on pages 38a and 38b.

Following is a brief description of those several types of steel roofing that are manufactured in sheet form.

Corrugated Roofing is made from flat sheets which have been formed into a series of alternate ridges and grooves, or hills and valleys, that run in the same direction. The reason for corrugating the sheets is to give them greater stiffness and load carrying ability. This type is illustrated on page 10. The sheet shown in Fig. 1 has corrugations which measure 2½ inches from the top of one to the top of the next. This type is referred to as "2½-inch Corrugated." In Fig. 2 the corrugations measure only 1¼ inches from ridge to ridge and this type is called "1¼-inch Corrugated." Both types are extensively used and, in the case of a tight deck (Fig. 1, page 14), personal taste largely determines the choice. On the open slat or purlin deck (see pages 14 and 15), the 2½-inch Corru-

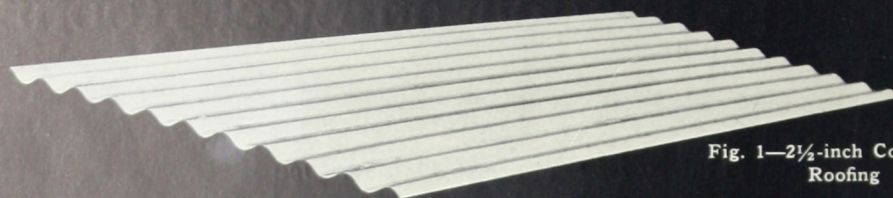


Fig. 1—2½-inch Corrugated Roofing

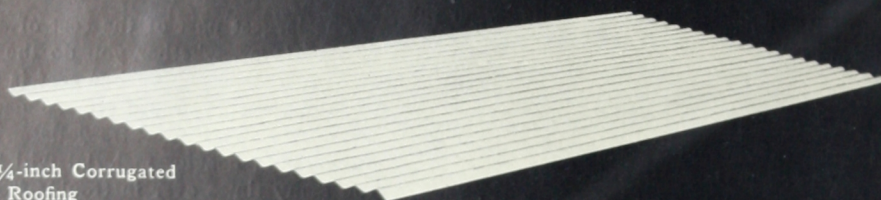


Fig. 2—1¼-inch Corrugated Roofing

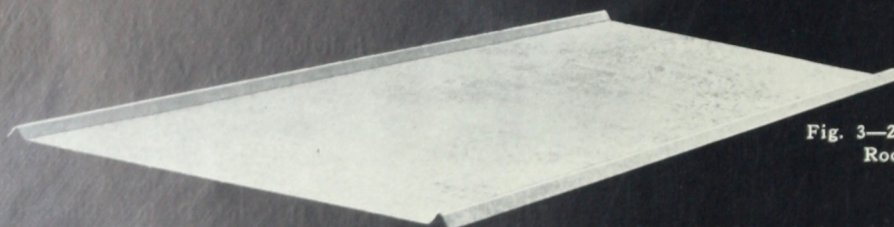


Fig. 3—2 V-Crimp Roofing

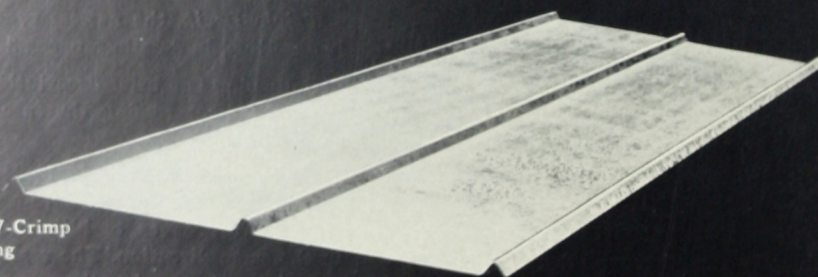


Fig. 4—3 V-Crimp Roofing



Fig. 5—5 V-Crimp Roofing

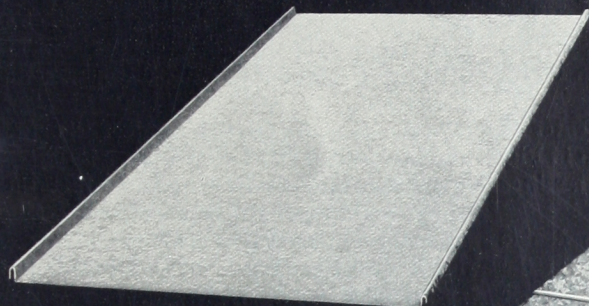


Fig. 1
Pressed
Standing Seam
Roofing

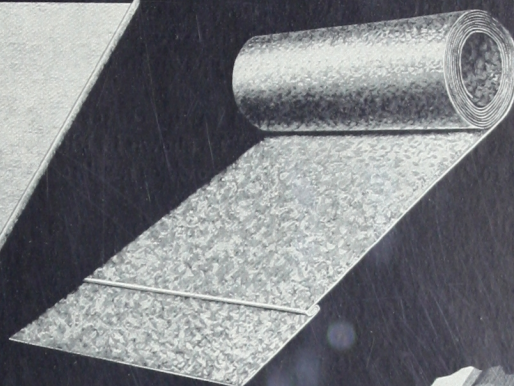


Fig. 2
Roll Roofing

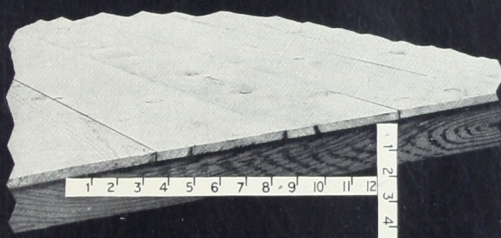


Fig. 3
Slight Slope
(2 inches in 1 foot)

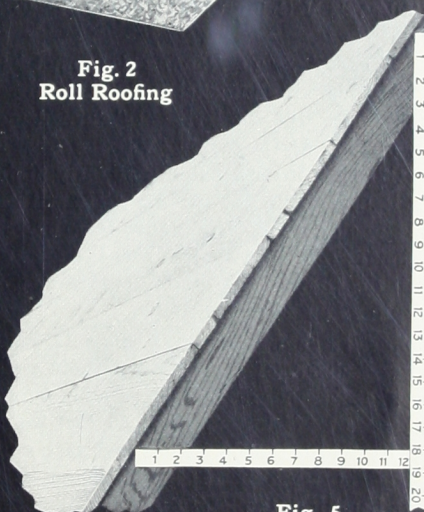


Fig. 5
Steep Slope
(18 inches in 1 foot)

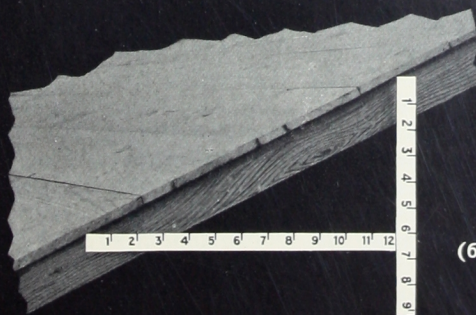


Fig. 4
Medium Slope
(6 inches in 1 foot)

gated provides the greater strength because of its greater stiffness.

V-Crimp Roofing is made from flat sheets by forming on each sheet two or more ridges that look like the letter "V" turned upside down. When only one crimp occurs at each side edge of the sheet, it is called "2 V-Crimp" as shown in Fig. 3, page 10.

When another crimp is placed in the center of the sheet it is called "3 V-Crimp" as shown in Fig. 4, page 10. This additional crimp provides a stiffer sheet for use in more windy locations.

A still more common type, using the double crimp along each side, also has a crimp in the center. These extra crimps provide still greater stiffness and offer further security against rain or snow being blown under the joints. This type is designated as "5 V-Crimp" and is shown in Fig. 5, page 10.

Pressed Standing Seam Roofing is somewhat similar to 2 V-Crimp roofing except that the raised portion looks more like the letter "U" turned upside down, instead of the letter "V." See Fig. 1, page 11. In this type the seam stands slightly higher, making it preferable for use on roofs with a very slight slope or pitch. The higher seam serves as an additional protection against seepage of rain water where the flow of the water from the roof is not as rapid as on a steeper slope.

Roll Roofing, as shown in Fig. 2, page 11, consists of several sheets of steel having their ends locked together at the factory by double cross seam locks so as to form one sheet 50 feet long. The customary width is 26½ inches and each roll has a net covering area of 100 sq. ft. when laid. To facilitate handling, the long sheet is put up in the form of a roll.

The flanging treatment of the side edges of the sheet when unrolled determines whether it will become Self-Capping Roll Roofing or Double Standing Seam Roll Roofing. One side edge of the sheet is turned up on the job to form a flange about 1½ inches high. The other edge is given a flange only 1 inch high. All sheets are flanged alike and laid on the roof side by side in such a manner that the taller flange of one sheet butts up against the shorter flange of the adjacent sheet.

When the taller flange is bent down over the shorter flange the seam thus formed gives this type the name "Self-Capping Roll Roofing."

When this seam is again folded over on itself

the type is known as "Double Standing Seam Roll Roofing."

Type of Steel Roofing to Use

The type of steel roofing best adapted to any particular building is determined somewhat by both the pitch of the roof and whether it is an old building or one under construction that is being considered.

In the case of a re-roofing job, if the old roof is wood or asphalt shingles that are still in such condition that they can be nailed down flat, they may be left on the roof if desired. However, if the old roof is prepared roll roofing, tar paper, slate or tile, it should be removed. The types of steel roofing for such conditions are, in the order of preference: Triple Drain, Pressed Standing Seam, V-Crimp or 1¼-inch Corrugated. If the old deck is of the open slat type with the slats more than 5 inches apart, the preferred type is 1¼-inch Corrugated.

In the case of a new roof deck yet to be built, there are two factors which enter largely into a determination of the best types of steel roofing to use; namely, whether the building is to shelter machinery or store materials not damageable by occasional drops of sweat, or whether the building is to house animals or both grain and animals. In the first case the most economical roof is 2½-inch Corrugated laid over a purlin type of deck with the purlins spaced about 5 feet apart. If the purlins are spaced not more than 3 ft. 9 ins. apart, 1¼-inch Corrugated may be used. In the second case—that of a building housing animals or both grain and animals—Triple Drain, Pressed Standing Seam, V-Crimp or 1¼-inch Corrugated should be used, and the deck should always be of the tight tongue and grooved type.

All of the foregoing recommendations must be considered in the light of the following restrictions which have to do with the pitch.

Do not use anything but Double Standing Seam on any roof with a pitch of less than 2 inches to the foot. Never use V-Crimp on a pitch of less than 2½ inches to the foot. Corrugated should never be used on a pitch of less than 3 inches to the foot.

The slope or pitch of a roof regulates the speed with which rain water or wet snow drains from its surface, and this slope therefore influences the decision as to what type or types of steel roofing are best adapted to any particular building. This pitch is measured as follows:

Put one end of a rule on the roof as shown on page 11 and hold it level. Measure the vertical distance between the roof and the rule at a point 1 foot out from that end of the rule which is touching the roof. This will designate the slope of the roof as, for instance, 2 inches to the foot or 6 inches to the foot, or 18 inches to the foot as illustrated in Figs. 3, 4 and 5, on page 11.

Four Types of Roof Decks

There are four general types of roof decks on which galvanized steel roofing may be used, namely, "tight" deck, "close" deck, "open slat" deck and "purlins." The tight deck consists of only tongue and groove boards, called sheathing, laid with the joints driven up tight. This is the recommended type of deck, and is shown in Fig. 1, page 14. The "close" deck consists of square edge or shiplap sheathing as shown in Figs. 2 and 3, page 14. When the sheathing is laid with open spaces between the boards, the deck is referred to as an open slat deck, as shown in Fig. 4, page 14. Sheathing boards of any size, such as 1x6 in. or 1x8 in. or 1x9 in. are nailed to the rafters with open spaces between which may range from one to one and one half times the width of the boards. In some instances these open spaces may run from 9 inches to 24 inches wide, depending upon the gauge and stiffness of the roofing and also upon how much saving it is desired to effect in lumber cost.

When heavy timbers, laid parallel to the eave and ridge and spaced several feet apart are used to support the roofing, they are called "purlins" and this is known as a purlin type of deck. These purlins are usually much heavier than ordinary rafters, but fewer of them are used. When using purlins and corrugated sheets of heavier gauge, no sheathing boards are necessary. This type of roof construction, long used in industrial building, has many applications on the farm, one of which is illustrated in Fig. 1, page 15.

Distance Between Roof Supports

On buildings which house animals, or in which people live or work, either a tight roof deck of tongue and groove boards or a tight ceiling should be used as an insulator to keep the warm air containing the moisture of their breaths from condensing into drops of sweat on the underside of the steel roofing.

Where no discomfort or harm will result from

a slight condensation of moisture, the most economical form of roofing is corrugated steel either on the open slat type of deck or supported by light timbers called purlins spaced as far apart as makes them suitably stiff, but in no case so far that there will not be at least one such board or timber under the end of each sheet and one under its middle in case the ends are more than $4\frac{1}{2}$ feet apart.

The spacing of these purlins can best be determined by laying two pieces of wood on the ground the same distance apart as the roof rafters, and by placing thereon, boards or light timbers at different distances apart under a sample sheet of the Corrugated roofing to be used. The stiffness of the sheet under the weight of a man will furnish a good guide for the proper spacing of purlins in the roof deck. In no case should the spacing be so wide as to result in damage to the roofing when walked upon. Corrugated sheets of No. 28 gauge are not stiff enough to span wide openings in the deck and carry much weight. On the other hand corrugated sheets of thicker gauge, such as No. 24 or No. 22, will support considerable weight.

Tight roof decks should preferably be made of tongue and groove roofing boards, which should not be more than 9 inches wide. These generally come a little more than $\frac{3}{4}$ inch thick and dressed on one side. They should be laid when quite dry and nailed up close with one toe nail and one center nail to each rafter. If laid tight when dry, they must be kept from getting wet before the roof covering is laid over them. Otherwise, they are liable to swell. If not laid dry, they are liable to shrink and open up at the joints enough to permit the warm moist air to come in contact with the underside of the cold roofing in winter and thus to cause some sweating.

Preparation of Roof Deck

It is essential that the roof deck be of sound lumber, free from rot and firmly attached to the supporting rafters or other frame work. All loose boards should be tightly nailed. Any decayed eave boards and rafters should be repaired. If preparing for a re-roofing job all debris and projecting nails should be carefully removed when the old roofing is torn off. Do not tear off more old roof than you can reasonably replace the same day, especially when the weather is uncertain. Make sure that the woodwork on the gable ends and eaves is true and



Fig. 2
Square Edge Sheathing

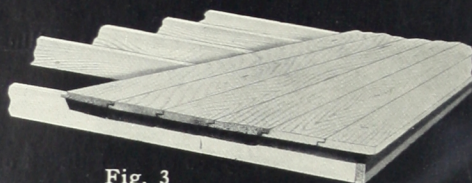


Fig. 3
Ship Lap Sheathing



Fig. 1
Tongue and Groove Sheathing

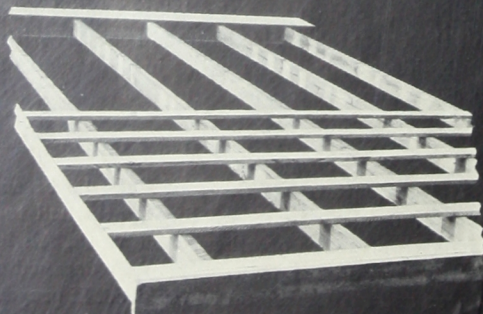


Fig. 4
Open or Slat Deck

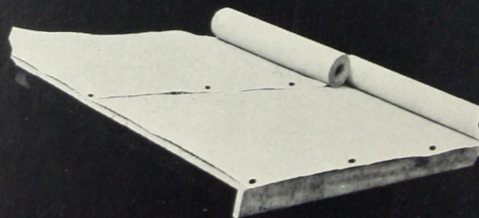


Fig. 5
Asbestos Felt



Fig. 1
Purlin Deck with Corrugated Roofing

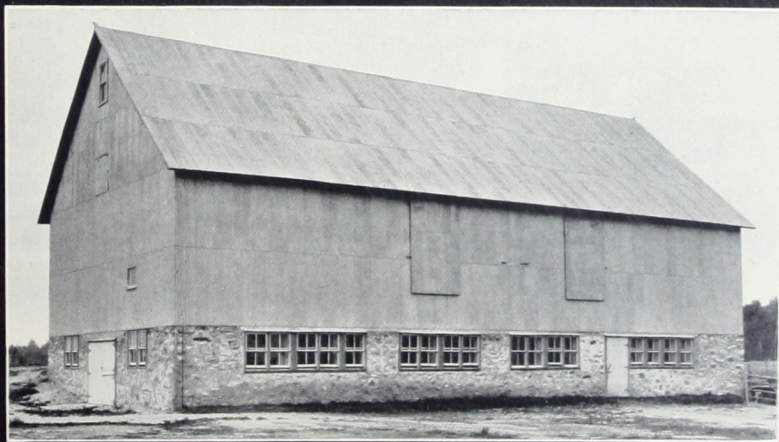


Fig. 2
Application of Galvanized Corrugated Sheet Steel for both Roofing and Siding. (Note the grounding rod at left corner)

even. If the eaves are untrue, stretch a line from one end to the other, mark it on the roof deck and saw to this line.

While manufacturers of some roofing materials advocate the application of their roofing over old roofs of shingles or other types—and sheet steel roofing can be and often is applied the same way—it is recommended that the old roofing material be removed and the new steel roof be placed on a clean deck, unless the old roof is of a kind and type that can be nailed down flat before the steel roof is applied. To place new steel roofing over an old, deteriorated roof or deck may often result in a slip-shod job. The little time saved by not removing the old and badly deteriorated roofing material may necessitate spending many extra dollars in subsequent repairs.

Use of Asbestos Felt Under Roofing

A good grade of 14 or 16 pound asbestos felt, which means that every 100 sq. ft. of felt weighs 14 pounds or 16 pounds, is recommended for use between a steel roof and the sheathing as an extra fire retardant. Also, in those cases where hot air, steam or chemical fumes, especially fumes containing sulphur, might come in contact with the underside of the steel, the asbestos felt serves the additional purpose of protecting the steel. See Fig. 5, page 14. This is the same kind of felt as is used for wrapping warm air furnace pipes. Never use tar paper under a steel roof because the acid in the tar injures the metal. Ordinary roofing papers are not fire resistant. In addition to protecting the steel the asbestos felt also acts as an insulator, and keeps residences or barns cooler in summer and warmer in winter.

Stock Sizes of Steel Sheets

It is helpful to know the various sizes of sheets and the roofing area they will cover, before measuring the roof. This will help in selecting those sizes which are most appropriate for any particular job. All corrugated galvanized sheets are sold per 100 sq. ft., called a "square." The price is based on the number of pounds per "square." Since no allowance is made for side or end laps, a "square" of roofing as shipped obviously is not equal to 100 sq. ft. of roofing when applied.

Figure 1, page 18, shows a sheet with corrugations that measure $2\frac{1}{2}$ inches from ridge to ridge.

Those $2\frac{1}{2}$ -inch corrugated sheets that measure $27\frac{1}{2}$ inches wide from edge to edge, have $10\frac{1}{2}$ corrugations, as shown in Fig. 2, page 18. One edge is turned up and the other edge is turned down, so that when laid with a side lap of $1\frac{1}{2}$ corrugations as shown in Fig. 3, page 18, the net width exposed to the weather is 24 inches or 2 feet. For instance, a roof measuring 50 feet long, would require twenty-five sheets of this width for each course.

Sheets usually found in stock measure 5, 6, 7, 8, 9, 10 and 12 feet long. The 11-foot length is a special length not made for stock. Some $2\frac{1}{2}$ -inch Corrugated roofing is made only 26 inches wide from edge to edge and has 10 full corrugations, formed with both edges down. By lapping only one corrugation on the side, Fig. 4, page 18, this style and size of sheet also covers an exposed space 24 inches wide. See Fig. 5, page 18.

While one corrugation lap on each side is sufficient for side walls of buildings, it is not recommended for roofs. It is much better in roofing to use the $27\frac{1}{2}$ -inch wide sheets, which will permit side laps of $1\frac{1}{2}$ corrugations and still provide a net exposed covering width of 24 inches.

In some sections of the United States the $27\frac{1}{2}$ -inch width is not carried in stock, while the 26-inch width is easily procured. The $1\frac{1}{2}$ -corrugation side lap may be had with this 26-inch width material by simply turning every other sheet face down. This will throw the side edges up so that the $1\frac{1}{2}$ -corrugation side lap is readily made. However, with this method, it is impossible to have all of the laps facing away from the origin of prevailing storms. It must be remembered that in using 26-inch width material with $1\frac{1}{2}$ -corrugation side lap that the net laying or covering width is reduced to $22\frac{1}{2}$ inches instead of 24 inches as noted above. Also, the side edges of this turned-over sheet must be placed under the side edge of each of the adjoining sheets. Otherwise this edge would hold water rather than shedding it.

Another popular type of roofing, especially in the southern states, is $1\frac{1}{4}$ -inch corrugated. These sheets measure $1\frac{1}{4}$ inches from the top of one corrugation to the top of the next as shown in Fig. 6, page 18. These sheets are not as stiff as $2\frac{1}{2}$ -inch corrugated of the same gauge because the corrugations are not as deep. The most common size of this sheet is 26 inches wide with 21 corrugations. One edge is turned up and the other

turned down. It covers a width of 24 inches when lapped $1\frac{1}{2}$ corrugations on the side, as shown in Fig. 1, page 19.

All of the several styles of V-Crimp roofing are made to lay 24 inches in exposed width, as shown in Figs. 2, 3 and 4, page 19. Like Corrugated, the sheets come in 5, 6, 7, 8, 9, 10 and 12-foot lengths. The 11-foot length is not a stock length. The required number of sheets of V-Crimp roofing is figured in exactly the same way as Corrugated roofing. The same sizes apply also to Pressed Standing Seam roofing, as shown in Fig. 5, page 19.

General Directions for Applying Steel Roofing

To remove the possibility of heavy winds driving rain and snow under the side laps of a sheet steel roof, it is advisable to start applying the sheets at that end of the roof farthest removed from the origin of prevailing storms. For instance, if the ridge of the roof runs north and south and prevailing storms are from a northerly direction, start applying the sheets at the southern gable end of the roof.

The Corrugated styles of galvanized steel roofing are usually applied one course at a time, from gable end to gable end and always starting at the eave rather than at the ridge. In some sections of the United States, however, it has been the local custom to apply corrugated sheets one row at a time, from the eave to the ridge. This local custom has its advantages in case of an unexpected rain, as well as some disadvantages. The roofer must decide which method shall be used, since it is more a matter of personal taste. Either method will result in a well-finished job.

V-Crimp, Pressed Standing Seam as well as Roll roofing are always laid one row at a time up the roof from the eave to the ridge. The approved method of applying Triple Drain is presented on pages 38a and 38b.

Since the exposed covering width of the various types of formed steel roofing is 2 feet, it is often necessary to project the eave length of a roof to the "next higher even foot," so that the number of sheets can be figured more easily. For example, if the true eave measurement (length of the eave from one gable end to the other), were 31 feet, 4 ins., this should be projected to an eave length of 32 feet, so that upon dividing the eave length by 2

(width of sheets in feet) the result is an even sixteen sheets. Fifteen sheets would not be enough to reach from one gable end to the other, and since the sheets are all made in 2-foot widths, it is necessary to figure on the basis of a 32-foot eave length.

In applying all types of formed steel roofing sheets except Corrugated, good construction demands that the steel project sufficiently over both the gable ends and the eaves so that it can be bent down over the wood deck. This serves to protect the wood from the weather and keeps it from rotting. These projections are referred to in this book as "gable end drip edge" and "eave drip edge." With Corrugated roofing the gable end drip edges are bent down over the edge of the wood deck, but the eave drip edges are permitted to overhang.

Good construction also demands that the edges of sheets overlap one another so that no leakage occurs. These laps are referred to in this book as "side laps" and "end laps"; the proper use of either of these expressions depending upon whether it is the side of the sheet that is being lapped or the end of the sheet.

It is because of the side laps that, for illustration, $2\frac{1}{2}$ -inch corrugated sheets which measure $27\frac{1}{2}$ inches wide from edge to edge, have a net width exposed to the weather of only 24 inches. The remaining $3\frac{1}{2}$ inches of width is taken up with the side laps. Also when determining the number of sheets needed from the eave to the ridge, it is necessary to figure the amount of each sheet devoted to end lap. The proper dimensions for gable end and eave drip edges and also for side laps and end laps are given farther on in the detail directions for the application of any one of the various types of steel roofing.

When applying Corrugated steel roofing, the nails are driven down through the top of the corrugations. In V-Crimp roofing it is necessary to order V-shaped sticks which fit in under the crimps. The nails are driven through the steel and V-shaped sticks into the roof deck. With Pressed Standing Seam roofing there are no nails driven through the roofing sheet itself, but side cleats and end cleats of steel are used to fasten the sheets to the roof deck. With Roll roofing, only the side cleats are needed because the ends of the sheets are fastened together at the factory with a double lock seam.

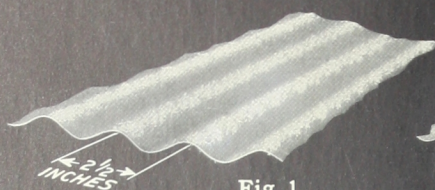


Fig. 1
2 1/2-inch Corrugation

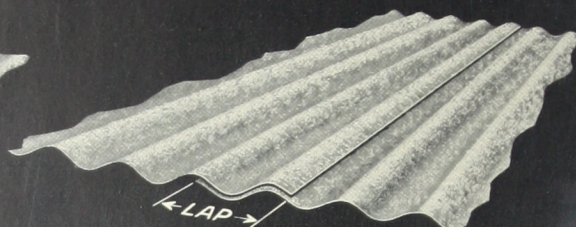


Fig. 3
1 1/2 Corrugations
Side Lap

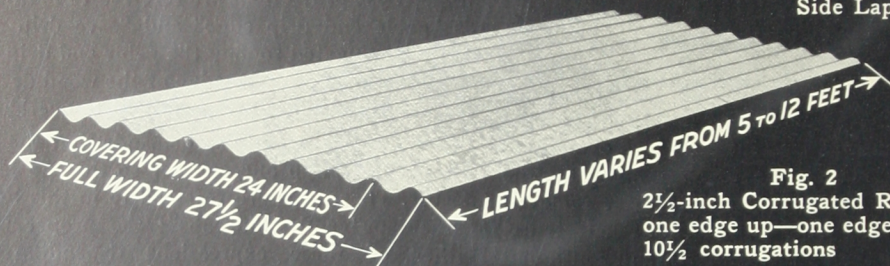


Fig. 2
2 1/2-inch Corrugated Roofing,
one edge up—one edge down.
10 1/2 corrugations



Fig. 4
1 Corrugation Side Lap

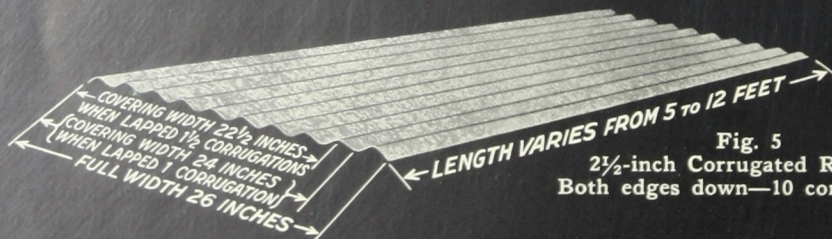


Fig. 5
2 1/2-inch Corrugated Roofing.
Both edges down—10 corrugations

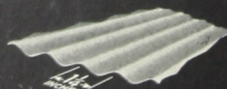


Fig. 6
1 1/4-inch Corrugation

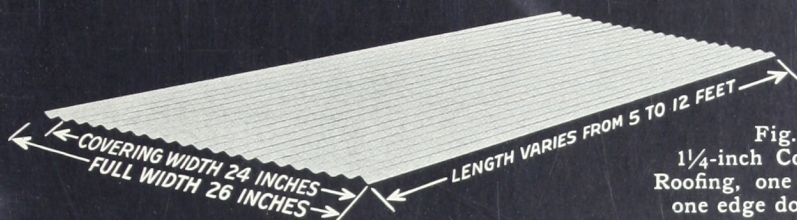


Fig. 1
1/4-inch Corrugated
Roofing, one edge up—
one edge down—20½
corrugations

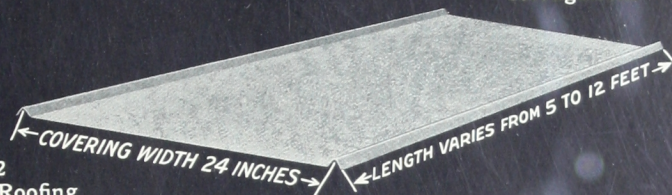


Fig. 2
2 V-Crimp Roofing

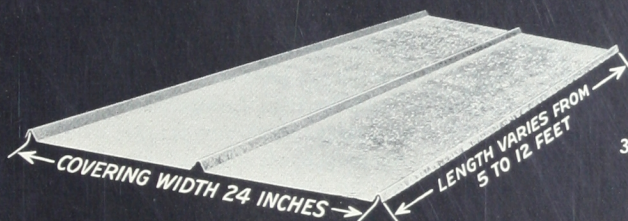


Fig. 3
3 V-Crimp Roofing

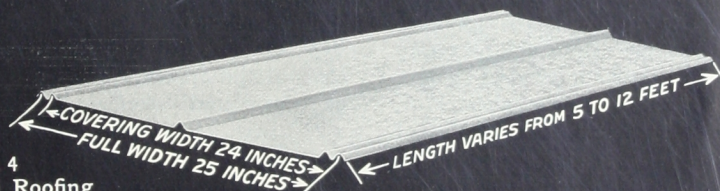


Fig. 4
5 V-Crimp Roofing

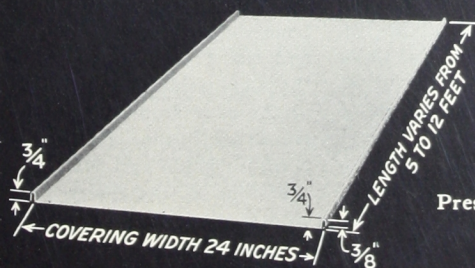


Fig. 5
Pressed Standing Seam Roofing

General Directions for Measuring Roofs

There is nothing more aggravating than to order a quantity of roofing and find, when the job is about finished, that two or three more sheets are needed to complete the work. There are two ways to avoid this and at the same time not have a large number of sheets left over. The first is to measure the building accurately, as described later, and send these measurements to the dealer. The dealer can easily figure the number of sheets required. The second is to do the figuring yourself.

Do not guess at measurements. Make sure by measuring the entire job with a reliable rule or measuring stick. Tape measures that stretch are not accurate.

Not all roofs are true, as is well known from actual experience. For example, the ridge may be a few inches longer or shorter than the eave, yet both may look alike to the eye. Conditions may vary on two sides of a ridge on the same barn or house. Therefore, it is necessary to have the correct measurements, whether the owner or the dealer figures the bill of material.

No consideration is here given to the measurement of any building for the use of sheet steel as side wall covering and as shown in Fig. 2, page 15. This use of steel requires different estimating and application. The following paragraphs explain briefly what measurements are necessary to determine the exact amount of steel roofing for the several types of roofs, namely, "shed" roof, "ridge" roof, "gambrel" roof and "L-shaped" roof.

With a shed roof, as shown in Fig. 1, page 22, it is necessary to have only two measurements: first, the length of either the low eave off which the water drips or the upper eave and second, the length of the slope from the low eave up to the high eave. The length of one eave and the slope at one end should be checked against the other eave and the slope at the opposite end to see if there is any pronounced difference.

With a simple ridge roof, true and square, as shown in Fig. 2, page 22, it is necessary to have only two measurements: first, the length of the eave on one side and second, the length of the slope from the eave to the ridge or comb. Check the measurements to see that the eave on one side, the ridge and the eave on the other side are all the same length. The length of the slope up the

roof at one gable end should be the same as that at the other gable end, and these two slopes should be the same on both sides of the ridge.

With a ridge roof having the slope on one side longer than on the other, as shown in Fig. 3, page 22, three measurements are necessary: first, the length of the eave; second, the shorter slope from the eave up to the ridge; and third, the longer slope from the other eave up to the ridge. The two eaves and the ridge should be the same length; the slopes at one gable end should be the same length as the corresponding slope at the other gable end.

With a gambrel roof having straight sloping eaves as shown in Fig. 1, page 23, three measurements are necessary: first, the length of the eave; second, the length of the slope from the eave up to the gambrel or hip joint; third, the length of the other slope from the gambrel joint up to the ridge. The lengths of the two eaves, two hip joints and the ridge should be alike. The lengths of the four slopes at one gable end should be the same as the corresponding slopes at the other gable end.

With a gambrel roof having flared eaves, as shown in Fig. 2, page 23, four measurements are necessary: first, the length of the eave; second, the length of slope of the flared eave from the eave to the eave joint; third, the length of the slope from the eave joint up to the gambrel or hip joint, and fourth, the length of the slope from the gambrel joint up to the ridge. All corresponding measurements on the other side of the ridge and at the opposite gable end should be the same or very nearly so.

With an "L"-shaped roof, as shown in Fig. 3, page 23, twelve measurements are necessary: First, the eave from the inside corner to gable end No. 1; second, the eave from the same inside corner to gable end No. 2; third, the length of the ridge from the intersection of ridge and valley to gable end No. 1; fourth, the length of the ridge from the same point to gable end No. 2; fifth, the length of the eave from the outside corner to gable end No. 1; sixth, the length of the eave from the same point to gable end No. 2; seventh, the length of the slope of the inside roof at gable end No. 1; eighth, the length of the slope of the outside roof at gable end No. 1; ninth, the length of the slope of the inside roof at gable end No. 2; tenth, the length of the slope of the outside roof at gable end No. 2; eleventh, the length of the valley for the inside roofs from eave to ridge; twelfth, the

length of the hip for the outside roofs from eave to ridge.

With a "T"-shaped roof as shown in Fig. 1, page 24, the measurements are similar to those made for an "L"-shaped roof except that there are two valleys instead of one valley and one hip.

How to Measure Roofs Having Hips and Valleys for Steel Sheet Roofing

Valley and hips are easily measured. The valley of the "L"-shaped roof shown in Fig. 2, page 24, will be described first and the hip later.

On this particular roof the length of the eave from the inside corner to gable end No. 1, is 51 feet and from the same inside corner to gable end No. 2 is 24 feet. The length along the ridge from the top end of the valley to gable end No. 1 is 70 feet and from the same point to gable end No. 2 is 43 feet. The length of the slope is 26 ft. 10 ins.

It is readily seen that two large areas of the roof, one 51 feet by 26 ft. 10 ins. (gable end No. 1) and the other 24 feet by 26 ft. 10 ins. (gable end No. 2) are easy to figure for the number of sheets of roofing required. They constitute two plain ridge roofs if the full valley area is eliminated for the moment.

The actual measured length of the slope (26 ft. 10 ins.) plus an allowance of 2 inches for the eave drip edge and 6 inches for each of two end-laps of sheets gives a total of 28 feet for actual sheet lengths. The best combination of sheet lengths would be two sheets of 10 feet each and one sheet of 8 feet. The number of sheets required to cover the inside slope of gable end No. 1 is now figured as follows:

52 feet (along eave) divided by 2 feet (covering width of one sheet) equals 26 sheets for one course.
26 sheets times two courses equals 52 sheets, each 10 feet long.
26 sheets times one course equals 26 sheets, each 8 feet long.

The number of sheets required to cover the inside slope gable end No. 2 is figured as follows:

24 feet (along eave) divided by 2 feet (covering width of one sheet) equals 12 sheets for one course.
12 sheets times two courses equals 24 sheets, each 10 feet long.
12 sheets times one course equals 12 sheets, each 8 feet long.

The full valley area, 19 feet each way along the ridge and 26 ft. 10 ins. on the slope, is now figured by the following rule which will apply for Corrugated, V-Crimp and Pressed Standing Seam roofing sheets only:

"For the full valley area, figure the number of sheets that would be required for one slope if the eave of this slope were as long as the ridge and no valley were there. Then increase this number by one-half."

This rule is easily understood when it is applied with dimensions to the valley of this same roof which is typical of any valley. This full valley area is 19 feet each way along the ridge. By using the next even foot higher, or 20 feet, as the measurement along the ridge, and by dividing by 2 feet (covering width of one sheet) this part, if the eave were as long as the ridge, would require ten sheets in width.

10 sheets times two courses equals 20 sheets, each 10 feet long.

10 sheets times one course equals 10 sheets, each 8 feet long.

The rule says to "add one-half the number of sheets" to this number, which is done as follows:

20 sheets plus 10 sheets equals 30 sheets, each 10 feet long.

10 sheets plus 5 sheets equals 15 sheets, each 8 feet long.

Summing up, the bill of material for the two inside slopes of gables No. 1 and No. 2, including the full valley area, is as follows:

10 Foot Sheets	8 Foot Sheets
52 sheets for gable No. 1	26 sheets for gable No. 1
24 sheets for gable No. 2	12 sheets for gable No. 2
30 sheets for valley	15 sheets for valley
106 sheets, each 10 ft. long	53 sheets, each 8 ft. long

A hip slopes the opposite way from a valley but the number of roofing sheets is figured in the same way. Fig. 3, page 24, shows the hip or outside corner of the same "L"-shaped roof, in which the length along the two major sections of the ridge and the length of the slope are all the same as shown in Fig. 2, page 24. It will be noticed that the length along each outside eave is greater than along the eaves on the inside slopes by 38 feet.

The amount of roofing sheets for the two larger areas of the roof outside of the full hip area, one 70 feet by 26 ft. 10 ins. (for gable end No. 1) and the other, 43 feet by 26 ft. 10 ins. (for gable end No. 2) are easily figured as follows:

Fig. 1
How to Measure
a Shed Roof



Fig. 2
How to Measure a Ridge Roof when
both slopes are of equal length



Fig. 3
How to Measure a
Ridge Roof when
One Slope is longer
than the other

Fig. 1
How to measure a Gambrel Roof having
Straight Eaves

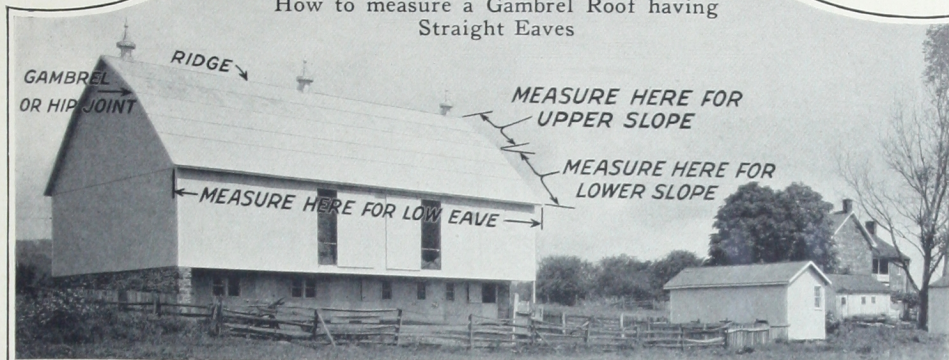


Fig. 2
How to measure a Gambrel Roof
having Flared Eaves

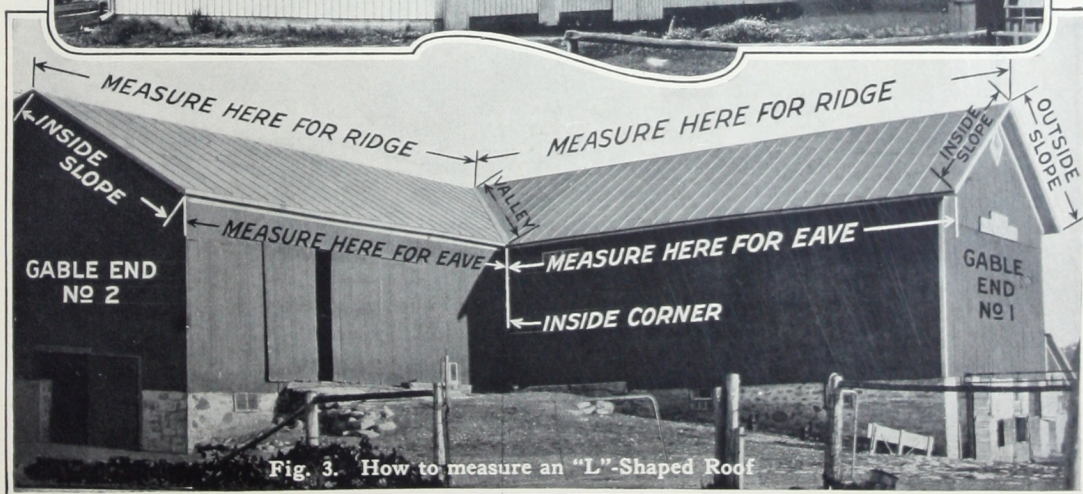
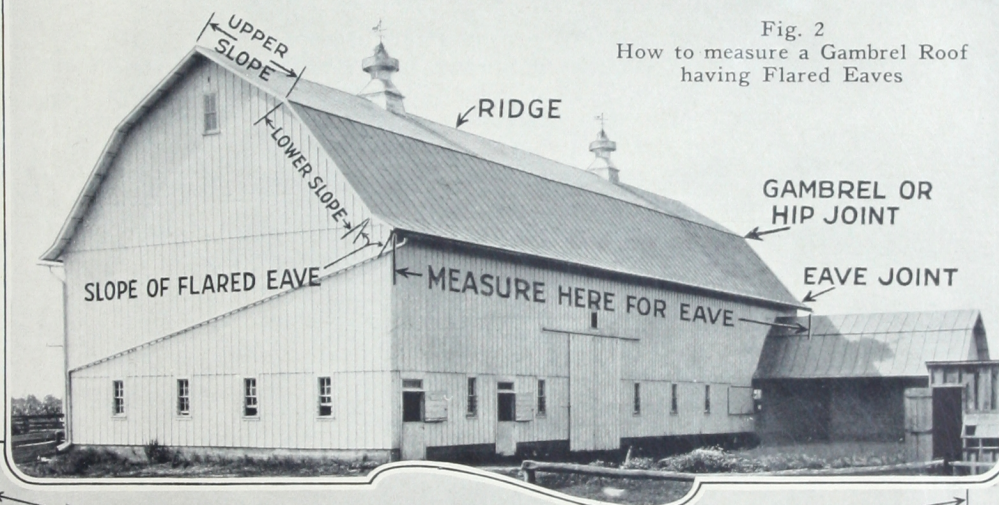
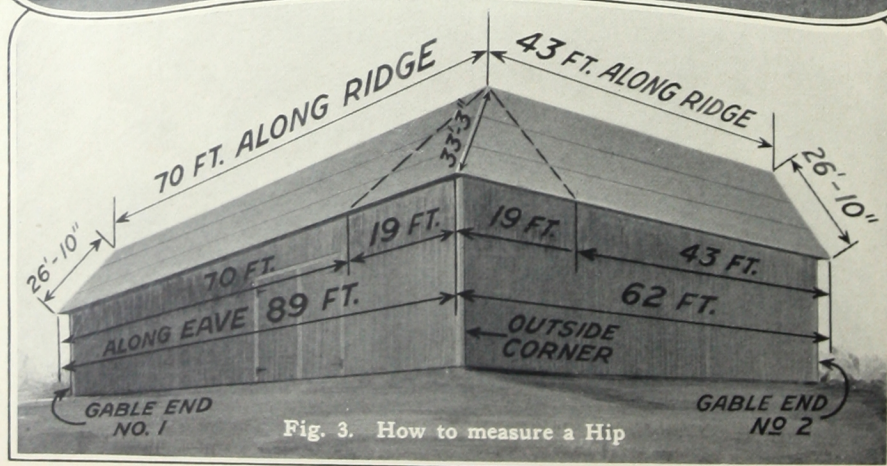
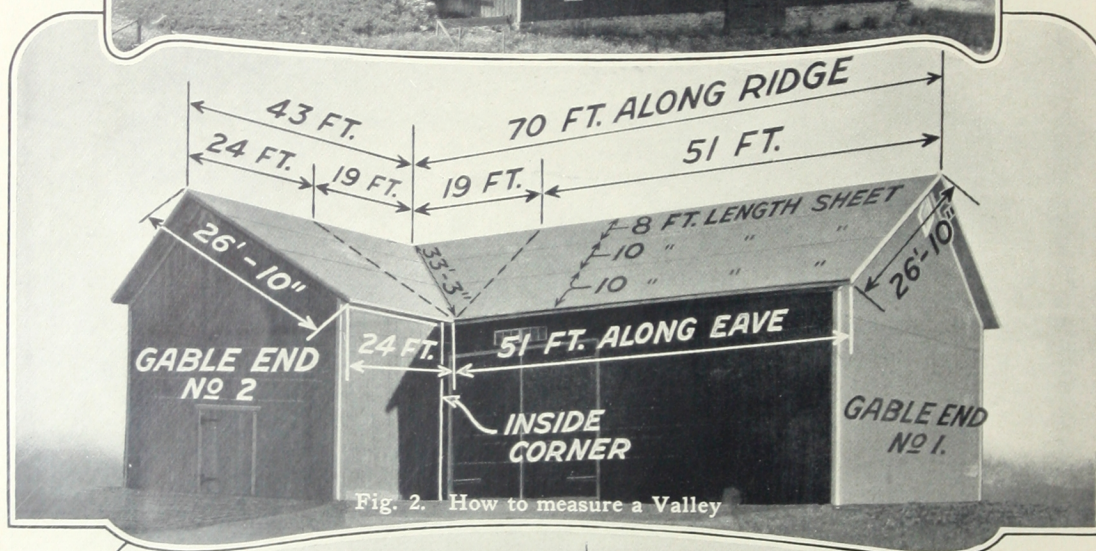
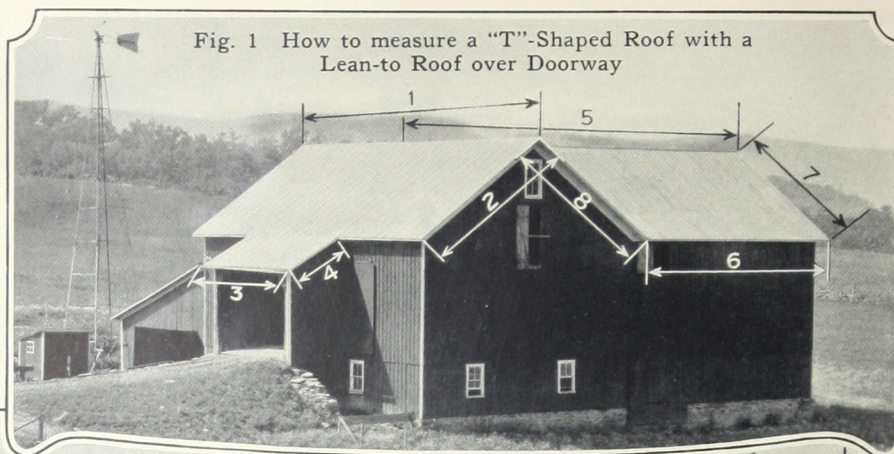


Fig. 3. How to measure an "L"-Shaped Roof



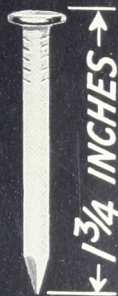


Fig. 1. Galvanized Nails



Fig. 3
Lead Washer



Fig. 2. Galvanized Nails with Lead Washers applied



Fig. 4
Common Bright
Nail



Fig. 5
Compressed Lead
Head Nail



Fig. 6
Cast Lead Head
Nail



Fig. 7
Galvanized Mush-
room Steel Head
Nail

Gable End No. 1

70 feet along ridge divided by 2 feet (covering width of one sheet) equals 35 sheets for one course.

35 sheets times two courses equals 70 sheets, each 10 feet long.

35 sheets times one course equals 35 sheets, each 8 feet long.

Gable End No. 2

44 feet along ridge divided by 2 feet (covering width of one sheet) equals 22 sheets for one course.

22 sheets times two courses equals 44 sheets, each 10 feet long.

22 sheets times one course equals 22 sheets, each 8 feet long.

For Corrugated, V-Crimp and Pressed Standing Seam roofing sheets, the hip is figured by the same rule as that used for the valley, namely:

"For the full hip area, figure the number of sheets that would be required for one slope if the ridge of this slope were as long as the eave and no hip were there. Then increase this number by one-half."

The hip area, 19 feet each way along the eaves and 26 ft. 10 ins. on the slope, is figured as follows, using the next higher even foot, namely 20 feet:

20 feet divided by 2 feet (covering width of sheet) equals 10 sheets for one course.

10 sheets times two courses equals 20 sheets, each 10 feet long.

10 sheets times one course equals 10 sheets, each 8 feet long.

The rule says to "add one-half the number of sheets" to this number as follows:

20 sheets plus 10 sheets equals 30 sheets, each 10 feet long.

10 sheets plus 5 sheets equals 15 sheets, each 8 feet long.

The bill of material for these two outside slopes of the "L"-shaped barn and including the full hip area, is as follows:

10 Foot Sheets	8 Foot Sheets
70 sheets for gable No. 1	35 sheets for gable No. 1
44 sheets for gable No. 2	22 sheets for gable No. 2
30 sheets for hip	15 sheets for hip
144 sheets each 10 ft. long	72 sheets, each 8 ft. long

The bill of material of formed roofing sheets for the entire roof area, both the inside and outside slopes and including hip and valley is as follows:

10 Foot Sheets

106 sheets for inside slopes
144 sheets for outside "

250 sheets, each 10 ft. long

8 Foot Sheets

53 sheets for inside slopes
72 sheets for outside "

125 sheets, each 8 ft. long

It must be remembered that this way of figuring the required number of sheets is a general rule that will apply for any valley or hip from a very flat roof of less than $1/6$ pitch to a steeper roof of more than $1/2$ pitch. Because the rule is very general, there may be a few more sheets left over in a large job than in a small one. This is desirable because loss of the time required to get one or two sheets needed to complete a job costs more than the sheets. Then too, any few sheets left over will come in handy in a dozen different ways.

Galvanized formed valley, hip finish and ridge roll should always be included in the order for formed sheets for a barn having hips and valleys.

How to Measure Roofs Having Hips and Valleys for Steel Roll Roofing

With Roll roofing, hips and valleys are somewhat easier to figure than with formed roofing sheets, because the waste is only that small three-sided corner cut off at the low end of each sheet as it is fitted into the valley, or at the high end of each sheet that is fitted at the hip. The rule for Roll roofing is as follows:

"For the full valley area, figure the number of widths of sheets that would be required for one slope if the eave of this slope were as long as the ridge and no valley were there. Then add 8 feet for each one of these widths."

In Fig. 2, page 24, the valley area is 19 feet each way along the ridge. Use the next higher even foot, in this case 20 feet, to determine the number of widths. Since the slope measures 26 ft. 10 ins. from ridge to eave, use 27 feet for estimating purposes.

The bill of material for the inside slopes of the larger roof areas (gable end No. 1 and gable end No. 2), as shown in Fig. 2, page 24, and leaving out the valley area, is arrived at as follows:

Gable End No. 1

52 feet along the eave divided by 2 feet (covering width of one sheet) equals 26 full widths.

26 widths times 27 feet, estimated slope, equals 702 lineal feet of Roll roofing.

Gable End No. 2

24 feet along the eave divided by 2 feet (covering width of one sheet), equals 12 full widths.
12 widths times 27 feet (estimated slope) gives
324 lineal feet of Roll roofing.

The rule is now applied to the valley, as follows:

20 feet along the ridge divided by 2 feet (covering width of one sheet), equals 10 full widths.
10 widths times 27 feet (estimated slope) equals
270 lineal feet of Roll roofing.
10 widths times 8 feet (additional per width according to the rule) equals 80 lineal feet, to be added.
270 feet plus 80 feet equals 350 lineal feet of Roll roofing for the full valley area.

Thus, the inside slopes, including the valley area, require:

702 lineal feet for gable end No. 1
324 lineal feet for gable end No. 2
350 lineal feet for full valley area

1376 lineal feet of Roll roofing

The rule for Roll roofing, applied to a hip, reads as follows:

"For the full hip area, figure the number of widths of sheets that would be required for one slope if the ridge of this slope were as long as the eave and no hip were there. Then add 8 feet for each one of these widths."

The bill of material for the outside slopes of the larger roof areas (gable end No. 1 and gable end No. 2) as shown in Fig. 3, page 24, and leaving out the hip, is arrived at as follows:

Gable End No. 1

70 feet along the ridge divided by 2 feet (covering width of one sheet) equals 35 full widths.
35 widths times 27 feet (estimated slope) equals
945 lineal feet of Roll roofing.

Gable End No. 2

44 feet along the ridge divided by 2 feet (covering width of one sheet) equals 22 full widths.
22 widths times 27 feet (estimated slope) equals
594 lineal feet of Roll roofing.

The rule is now applied to the hip, as follows:

20 feet along the eave divided by 2 feet (covering width of one sheet) equals 10 full widths.
10 widths times 27 feet (estimated slope) equals
270 lineal feet of Roll roofing.
10 widths times 8 feet (additional per width according to the rule) equals 80 lineal feet to be added.
270 feet plus 80 feet equals 350 lineal feet of Roll roofing for the full hip area.

Thus, the outside slopes, including the hip require:

945 lineal feet for gable end No. 1
594 lineal feet for gable end No. 2
350 lineal feet for full hip area

1889 lineal feet of Roll roofing.

The bill of material for the entire roof, both inside and outside slopes, plus hip and valley, sums up as follows:

1376 lineal feet for inside slopes and valley
1889 lineal feet for outside slopes and hip
3265 lineal feet of Roll roofing

Since Roll roofing is usually sold in rolls 50 feet long, this total, 3265 feet, divided by 50 feet to a roll, equals 65-1/3 rolls.

The proper order would be for 66 rolls. It is better to have a little left over for use on occasional jobs than to be caught short a few feet. Galvanized Roll roofing should be not lighter than No. 28 gauge.

In many cases the valley is roofed with the same gauge of Roll roofing; in other cases a heavier gauge formed valley is used.

In some cases the hip and ridge are finished with a standing seam; in other cases the seam is omitted and ridge roll is used as a finish. If the formed valley and ridge roll are used they must be added to the bill of material for Roll roofing.

Kind of Nails to Use

Galvanized Corrugated, V-Crimp and Pressed Standing Seam roofing should be fastened to the roof deck with galvanized barbed nails as shown on page 25. These nails usually can be obtained where the galvanized roofing is purchased. Figs. 1 and 2, page 25, show these nails with and without washers applied.

Lead washers as shown in Fig. 3, page 25, are recommended for use with nails having ordinary heads. These serve as a preventive against rust which otherwise usually starts at the nail holes in case the galvanized coating is accidentally broken in nailing. This is important because water tends to collect around the nail head.

Whatever type of nail is used, the shank or long stem should be roughened up to give it a better grip in the wood deck. The sizes most commonly used on clean roof decks are 1 3/4 inches and 2

inches long. When applying steel roofing over an old roof, be sure the nails are long enough to go through the old roof surface and the wood deck underneath.

Where nails are galvanized, they are called Hot Galvanized Standard Barbed Roofing Nails and must be ordered by their length. While the galvanized nail is preferred—and always recommended where available—there are some sections where they are not carried in stock, while uncoated common or “bright” nails as shown in Fig. 4, page 25 are readily obtained. When the shanks of these “bright” nails are not barbed it is better to use longer nails. Eight penny common nails are $2\frac{1}{2}$ inches long and have about 106 nails per pound. Ten penny common nails are 3 inches long and have about 69 per pound. Nails $1\frac{3}{4}$ inches long usually number about 151 per pound, and the 2-inch nails about 103 per pound.

Fig. 5, page 25, shows one type of the several types of special lead headed nails in which the lead is already firmly compressed to the nail head in the process of manufacture. These types of nails allow the roofer to work faster because he handles one nail complete instead of a nail and a washer. They are made in the same sizes and lengths as the standard barbed roofing nails.

Another form of lead head on roofing nails is shown in Fig. 6, page 25, which is known as a cast lead head. The small projection at the top of the head is also lead which, when hit with the hammer, flattens down. This type of cast lead head nail contains more weight of lead than the compressed lead head nail and consequently weighs heavier for the same number of nails. In a keg of nails weighing 100 pounds there is about 50 per cent more compressed lead head nails than cast lead head nails. In other words, a keg of compressed lead head nails will lay 50 per cent more squares of Corrugated steel roofing.

Another kind of roofing nail is that shown in Fig. 7, page 25, in which the steel shank continues up through the top of the steel mushroom-shaped head. The head is made as a part of the barbed shank so that it will not slip when driven in place. These nails are galvanized after the heads are formed.

When common nails, mushroom head nails or compressed lead head nails, $1\frac{3}{4}$ inches long, are used with Corrugated or V-Crimp roofing, it is safe to figure on one pound of nails for each

square of roofing. This allows enough nails to finish the eave and gable drip edges and the ridge. If cast lead head nails of the same length are used with these two types of roofing, it is necessary to figure on one and one-half pounds for each square of roofing.

In the case of Pressed Standing Seam, Self-Capping Roll roofing or Double Standing Seam Roll roofing, calling for 1-inch nails, it is safe to figure on one-third of a pound for each square of roofing.

Lead Washers Essential

Lead washers come already cut to the right size with the centers slightly raised and a hole punched in them. They usually can be bought where galvanized roofing is sold. The head of the nail forces the washer tightly against the sheet. This seals the hole against the entrance of moisture and prevents the nail head from cutting the sheet or injuring the coating. Where roofing nails with specially designed heads are used, no lead washers are needed.

The slight cost of lead washers makes their use a real economy, especially when common nails are used. The No. 8 lead washers, which fit the sizes of nails mentioned in the previous section, come packed in 5-pound cartons or may be bought in bulk. One pound contains about 325 washers, roughly sufficient to apply three squares, or 300 square feet of roofing.

Grounding a Steel Roof Against Lightning

The end view of the building shown in Fig. 1, page 30, serves the purpose of illustrating how to connect or “ground” a sheet steel roof to the earth by the simple use of a rod, pipe or cable, and thus protect the building against damage from lightning striking the roof. The rod along side of the brick chimney is connected to the Corrugated steel roof and the roof in turn is connected at the eave with a piece of pipe that extends down the side of the house near the corner. This pipe is spliced to another pipe which is driven deep into moist ground. Each of these connections is clearly shown in the larger sectional details of the general view.

The connection from the eave to the ground is made first as shown in Fig. 3, page 30. If possible,

the pipe or bar should be long enough to reach from the eave line to the ground in one piece. However, if it is necessary to join two pieces this can be done by using a standard galvanized threaded pipe coupling, making sure that all threads on both pipe ends are fully covered by the coupling.

Select the location for the connection of the pipe to the roof at the eave and mark it with a pencil. Let a stone, the size of an egg, drop from this point on the eave to the ground, and mark the point on the ground where the stone hit. At this point drive a piece of $\frac{1}{2}$ -inch galvanized pipe into the ground so that the lower end is below the top of permanently moist earth. The location of permanently moist earth depends upon local conditions. It is better to drive the bar unnecessarily deep than not to have it deep enough. A fair average for earth, free from shale or stone, is 6 to 8 feet deep. If the upper end of this pipe is permitted to project about one foot above the surface of the ground, the connection with the sidewall pipe is easily made.

The sidewall pipe is held to the building by galvanized screw hooks, $\frac{5}{16}$ inch in diameter by $4\frac{1}{4}$ inches long. These are spaced about 6 feet apart or as local conditions permit. These hooks should be screwed into the building so that the inside edge of the pipe is not closer than 2 inches to the side wall. The upper end of the pipe is flattened for a length of about 3 inches, drilled for two bolts $\frac{1}{4}$ inch in diameter, and the end bent either down along the projecting eave and away from the sidewall as shown in detail No. 2 or up along the roofing towards the sidewall. The corresponding holes in the roofing should be on top of the corrugation to insure water-tightness. The bolt head and a flat washer should be used on top of the corrugation while the nut and a $\frac{1}{4}$ -inch lock washer should be used on the underside of the connection.

In the case of Corrugated roofing, which has an overhang of 2 inches at the eave, it will be necessary to cut an oblong notch into the wood deck to accommodate the 3-inch connection. This notch must be wide enough and long enough to keep the edges of the wood deck at least 2 inches away from the connection. In all other types of steel roofing, because the steel is bent down over and nailed to the wood eave drip edge, it will be necessary to cut an oblong hole in the wood deck to ac-

commodate the connection. Again be sure the edges of the hole are at least 2 inches away from the connection. The reason for this precaution is to prevent the wood deck catching fire due to excessive heat caused by the passage of lightning from the large roof area down the comparatively small ground connection. It is for this reason also that the grounding rod is kept 2 inches away from the side of the house.

After the pipe has been inserted in the screw hooks and bolted fast to the roofing, the ends of the screw hooks should be bent shut so as to hold the pipe firmly to prevent rattling and also to support its weight rather than allowing it to hang entirely from the roofing.

In those instances where the gutters are not in metallic contact with the roof, as is the case when the hangers are fastened to the rafter ends, it is necessary to form a contact by connecting the gutters either to the steel roof or to the grounding rod by means of a wire or piece of steel strap.

The bottom end of the sidewall pipe is fastened to the top end of the grounding pipe with two galvanized wire rope clamps, by placing the pipes between the inner sides of the yoke, as shown in Fig. 3, page 30. These clamps should measure $\frac{3}{4}$ of an inch between the two stems of the yoke.

Figure 4, page 30, shows the method of attaching the masonry chimney protector which is made from a piece of $\frac{1}{2}$ -inch galvanized pipe or bar, to the brick work of the chimney and also to the metal roof.

The length of this pipe depends upon three things: first, the length bent over the base flashing at the roof line, usually 4 to 6 inches; second, the height from the roof line to the top part of the masonry chimney and third, the length of the projection above the top of the chimney, which length is equal to one-half the distance from the bar to the farthest corner on top of the chimney. For instance, if it is 20 inches from the pipe to the farthest corner of the chimney, then the projection of the pipe above the chimney should be at least 10 inches. If the top of the chimney were 30 inches above the roof line, the total length of this pipe for the chimney protector, after bending the pipe 6 inches to attach it to the roof, would be 6 inches plus 30 inches plus 10 inches, or a total of 46 inches.

This protector is held to the chimney by means of a bent piece of steel bar 2 inches wide by $\frac{1}{8}$

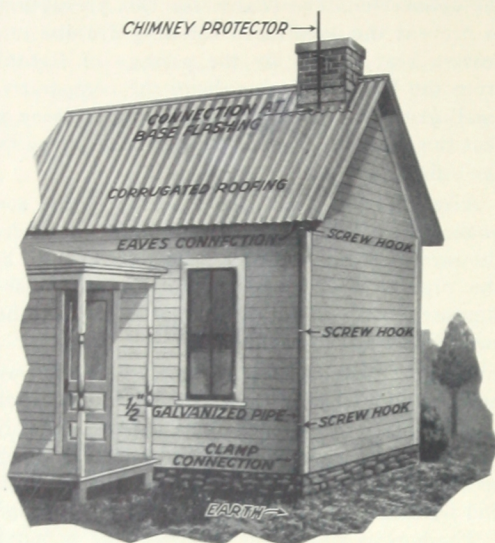


Fig. 1
General View of Grounding
Connections and Chimney Protector

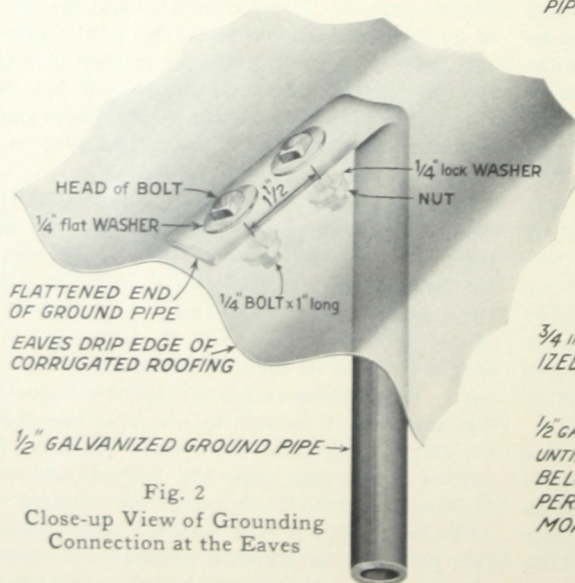


Fig. 2
Close-up View of Grounding
Connection at the Eaves

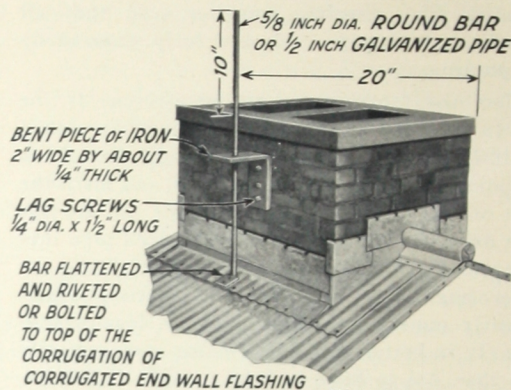


Fig. 4
Close-up View of Protector
attached to a Chimney

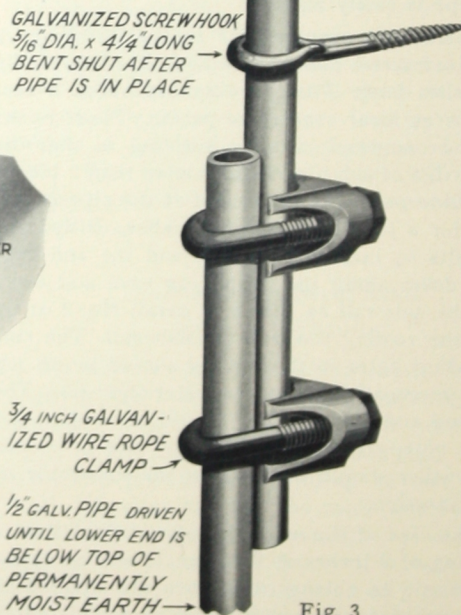


Fig. 3
Close-up View of Clamp
Connection at the Earth

HOW TO GROUND A STEEL ROOF AGAINST DAMAGE FROM LIGHTNING

Note: Paint all exposed surfaces well immediately after assembling.

to $\frac{1}{4}$ inch thick. The middle of the hole for this protector should be 3 inches away from the brick work unless the chimney cap or ornamental brick work projects so far as to require more than 3 inches to let the bar pass.

The vertical leg of this bent bar has three holes in it, each large enough to take a $\frac{1}{4}$ -inch diameter lag screw $1\frac{1}{2}$ inches long. The holes should be spaced about $2\frac{1}{2}$ inches apart which is the usual distance between mortar joints. The lag screws should be started into the mortar joints by driving them with a hammer. When they are about half way in, screw them up tight with a wrench fitted to their square heads.

The lower end of this protector bar should be flattened for a distance of 4 to 6 inches. The holes in this end, spaced $1\frac{1}{4}$ to $1\frac{1}{2}$ inches apart, should be large enough to admit either rivets or bolts $\frac{1}{4}$ inch in diameter. These holes may be drilled while the bar is straight and the end bent afterward to the right slope. The corrugated end wall flashing (see Chapter VII) which fits over the end of the Corrugated roofing at the bottom of the brick work should be drilled or punched with three holes to correspond with the holes in the protector. These three holes in the flashing should be on top of the corrugations when the flashing is fitted into its final position.

The connection of the bar to the flashing steel may be made in either one of two ways. The first and preferred way is to use rivets so that the connection is permanently tight and the upset heads of the rivets on the underside of the flashing are small enough to allow the corrugations to come into close contact. The other way is to use bolts and washers on the underside of the flashing and nuts on top of the bent bar end. In either case the rivets or bolts should be painted on both sides after assembly and before erection.

After these grounding connections have been completed, all exposed surfaces of pipe, nuts, washers, screws, clamps, etc., should be given one priming coat of paint and then, when thoroughly dry, given another coat colored to harmonize with the sidewalls.

Safe Scaffolds Recommended

The application of steel roofing, the painting of a roof or any work of whatever nature upon or in connection with a roof requires that "Safety First" be practiced above any saving of a few dol-

lars. The little time required to prepare a safe scaffold and the small expense involved warrant doing the job right. A broken leg, arm or back will cost more than a scaffold. In erecting a scaffold, the use of good planks, strong supports and heavy nails is earnestly recommended.

Figure 4, page 32, shows a strong yet inexpensive scaffold made with heavy saplings or young trees spaced about 12 feet apart, stiffened or braced with an "X" bracing at one end and with diagonal or slanting bracing at other points as illustrated. Small blocks are nailed to the barn. Short sticks are nailed to these blocks and to the uprights. The planks are 2 inches thick by 10 or 12 inches wide and 14 feet long. This permits a lap of 1 foot over each support.

Figure 3, page 32, shows a home-made bracket which is firmly nailed to the side of the barn. These brackets are easily made from short pieces of lumber and they serve the purpose very well when long uprights are not available. Figure 2, page 32, shows these brackets used on a barn 100 feet long, in which instance 16-foot planks were used.

Figure 1, page 32, shows scaffolding in which the uprights have been spliced or pieced together to make them long enough. Be sure to use plenty of nails in the pieces used to cover the joints. The cross braces have been nailed also in the middle where one crosses the other.

Figure 3, page 33, shows a cleat board, sometimes called a "chicken" ladder, which is made by firmly nailing small cleats on a long board with extra large cleat on the underside at the top. The large cleat at the top hooks over the ridge and the board lies flat on the roof.

Figure 4, page 33, shows an ordinary ladder with an iron rod safety hook bolted to the top. This hook fastens over the ridge of the roof and, because of its curved opening, permits a ridge roll to be applied by slipping it under the opening without moving the ladder. Another superior feature about this ladder is that the hooked end does not dent a ridge roll as a cleat board would tend to do. This hooked ladder should find many uses on any farm and is an excellent safety-first device for roofing work.

Figure 2, page 33, shows one of several types of factory-made wall brackets that may be fastened to the walls of any building by driving three or four heavy nails or spikes through the siding into

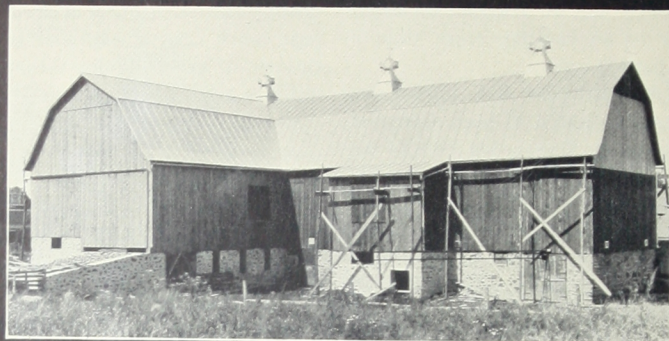


Fig. 1. Spliced Uprights used in this Scaffold

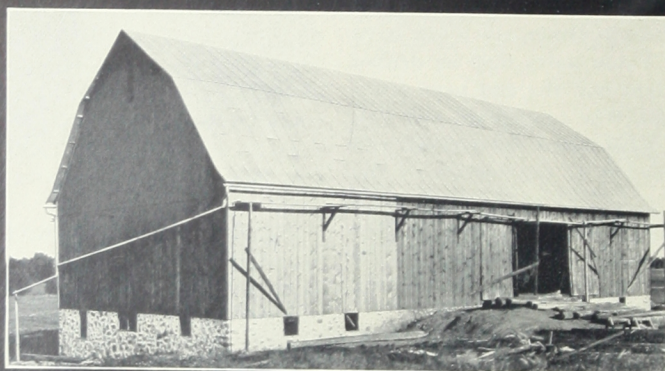


Fig. 2. Home-made Brackets support this Scaffold

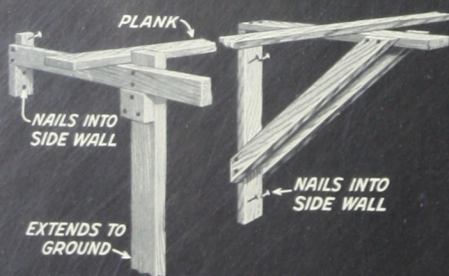


Fig. 3
Close-up view of home-made Brackets

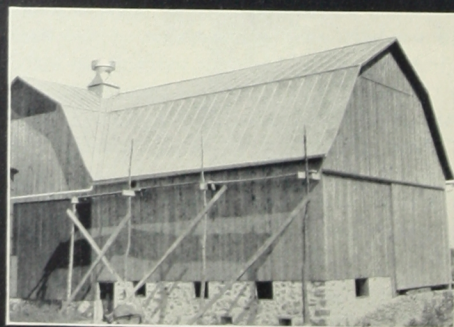


Fig. 4
Crude Scaffolding using young trees

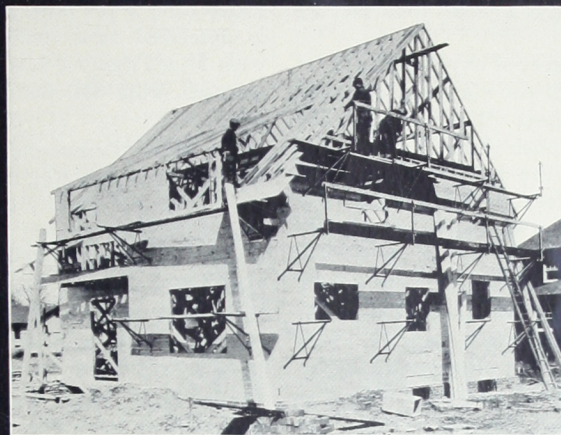


Fig. 1. Factory-made Brackets applied to Walls

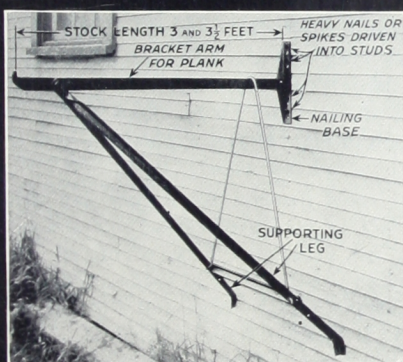


Fig. 2
Close-up view of Factory-made
Brackets



Fig. 5
Showing use of Ladder Jacks to
Support Scaffold

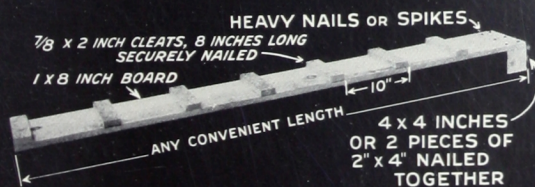


Fig. 3
Cleat Board or "Chicken Ladder"

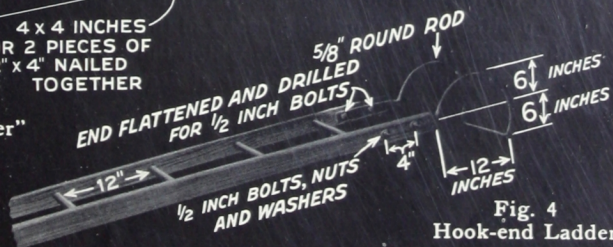


Fig. 4
Hook-end Ladder

the studs. If there is no stud at the place where the bracket should go it is best to clinch the nails on the inside of the siding to prevent their pulling out.

These brackets may be spaced any distance apart according to the length of the planks being used, as is shown in Fig. 1, page 33. To remove the brackets from the walls, push the nailing base up until the large part of the hole is around the nail, and lift the base over the nail heads. The nails can then be taken out or driven completely in.

Another type of scaffold support is provided by the use of "ladder jacks" which hook over the rung of a ladder as shown in Fig. 5, page 33. These ladder jacks may be placed in either of two positions. One supports the plank above the ladder, as shown in the upper part of this photograph. The other suspends the plank below the ladder as shown in the lower part of this same photograph. As the safety of this scaffold depends upon the strength of the rung of the ladder, it is necessary that this rung be absolutely sound. Otherwise, nail a strong board across the ladder to serve in place of the rung as a support for the ladder jack.

Tools for Steel Roofing

In the application of steel roofing there are several common tools which help to make the work easier. Some of these can be put to frequent use in other work around the home.

These tools are snips, compound lever shears, hammers, pliers, flanging tongs, squeezing tongs and double seamers.

The term "Tinner's Hand Snips" applies to the tool shown in Fig. 1, page 36, which looks something like an extra heavy pair of scissors with short blades. The long handles give more power to the cutting blades. Snips are made for use by a right-handed or left-handed man, the difference being in the position of the cutting blades and the shape of the handles, called bows, into which the fingers fit. It may sound a little confusing at first but the description given by manufacturers of snips is as follows: "A left-hand snip is one which when held in the right hand, has the lower blade on the left side of the cut or snip." The snips shown in Fig. 1, page 36, are left-handed snips for use by a right-handed man and are always sent in response to any order unless right-hand snips are ordered specially.

Each manufacturer of snips has a certain name and number for a style and size. The pair of snips illustrated, is the most popular style and size, and is described as a straight blade, left-hand snip, with 3-inch cutting blade and 13½ inches length over all. This will easily cut metal 26 gauge and lighter.

The term "Compound Lever Shears" applies to the tool shown in Fig. 2, page 36, which is similar to the "snips" shown in Fig. 1, page 36, except that the upper handle, into which the thumb fits, is made with two extra parts which form the compound levers. These increase the cutting power of the blades, or in other words, decrease the force necessary to be applied by the thumb. It is readily seen that these shears are for use by a right-handed man. Some manufacturers of compound lever shears have the compounded parts on the bottom handle, but the operation is the same.

There are two sizes of these shears which are commonly used. One size, known as No. 12, is 12 inches long and has a 3-inch cutting blade. The next larger size, No. 14, is 14 inches long and has a 3¼-inch cutting blade. Some mechanics prefer compound lever shears exclusively and do not use the tinner's hand snips.

All tools demand some care and attention if they are to give the best service and last a long time. An occasional drop of oil on the cutting blades and at the pivot of snips or shears will help to preserve a sharp edge and allow them to work easily. If occasion demands that snips or shears be sharpened, each blade should be re-ground at right angles to the inside of the blade. The burr on the cutting edge should be removed with a fine oil stone. The edges for cutting steel should be square instead of beveled as they are on a pair of ordinary scissors or a knife blade. Care should be exercised in the grinding so that the temper is not drawn. When thoroughly oiled, the bolt should be tight enough so that the free weight of the handle will not open the snip. Loose snips get dull quickly.

Hammers are made in several designs, one of which is the claw-hammer so commonly used by carpenters. The sheet metal worker's hammer usually has a solid top instead of the split or claw-top. The hammer shown in Fig. 3, page 36, is a riveting hammer and has a wedge-shaped top and an eight-sided or octagon face. The commonly used size of this hammer has a 1-inch face, is 12

inches long and weighs 18 ounces or $1\frac{1}{8}$ pounds. Another hammer frequently used is similar to this one and is known as a setting hammer. It has a square face and the top has a chisel shape.

The seams and flanges of several types of steel roofing are easily turned with the use of flanging tongs, sometimes called turning or seaming tongs, as shown in Fig. 4, page 36. The left-hand blade has two prongs fastened in it, each near the top end. These prongs fit into holes in the right-hand blade. As the two handles are closed these blades come together so that the bottom edges get a firm grip on the steel sheet to be turned. The height of the prongs above the bottom edge determines the height of the flange that can be turned on the sheet. There are five sizes or heights of prongs according to the size of the seams turned, these five being $\frac{1}{2}$ inch, $\frac{3}{4}$ inch, 1 inch, $1\frac{1}{4}$ inch, and $1\frac{1}{2}$ inches high. The tongs shown in Fig. 4, page 36, are for $1\frac{1}{2}$ inch flanges. This style of tongs is common with the older experienced mechanics.

The newer type of flanging tongs, known as "adjustable pin" flanging tongs, shown in Fig. 5, page 36, are the same general size as common tongs but the width of the flanges turned is governed by the position of an adjustable pin. There are five threaded holes in each end into which the adjustable pin may be placed. The other blade has corresponding holes for the pin extension. By the use of this one pair of adjustable pin tongs the same work can be done which would require five different pairs of common tongs with fixed jaws.

Where two or more thicknesses of metal form a seam, such as in Pressed Standing Seam or Self-Capping Roll roofing, and it is desired to have the metal squeezed up tight, the squeezing tongs shown in Fig. 6, page 36, give the best results. The style of handles varies a little with the different manufacturers but the fundamental operation of the squeezing jaws is the same. The usual depth of these jaws is $\frac{7}{8}$ inch. The handles of these tongs are spread apart instead of being pulled together when squeezing a seam.

The application of Double Standing Seam Roll Roofing is best done with the use of the roofing double seamers as shown in Fig. 7, page 36. This tool will turn the locks evenly and will leave the top of the formed locks at a uniform height even if the roofing boards are a little uneven. It will form the double seams on the hips and ridges as easily as on the main roof. This type of seamer is

made in two weights, the lighter being used only for very thin steel, and the heavier being used for steel roofing of No. 28 gauge or thicker. Figure 7, page 36, shows one pair only of these double seamers. It requires two such pairs, the second of different flanging height, to complete a set for the four operations of making a double standing seam. The seamer shown has a $1\frac{1}{2}$ -inch flanging bar across the bottom and is used in the first operation. The second seamer has a 1-inch flanging bar and is used in the third operation. The foot pedal is alike on both seamers and is used in the second and fourth operations.

Maintenance of Steel Roofing

Roofing receives more severe punishment than any other material on the outside of a building. All roofing materials, unless protected by renewable coatings on their outside, waste away as time goes on. Some do this by drying out, others by the flaking off of the surface, and still others by the formation of salts of different colors, some blue-green, some white and some reddish-brown (rust), which gradually wash away and are replaced by other salts of the same color. In forming these salts, the solid metals are consumed and eventually eaten through in places. The length of time required for this to take place depends upon the atmosphere. In dry, pure atmospheres, sheet metals will last for many, many years without protection, while in moist atmospheres, possibly filled with smoke and fumes of a sulphurous or other chemical nature, the corrosion of metals of any kind will be more rapid.

Steel itself is a "strength" metal and, if properly applied and protected, as a roofing material it will furnish an everlasting barrier against the entrance of water and wind.

The galvanizing on a sheet of steel must be considered as only the first coat of protection. It, as well as any other protecting coat, will become thinner and gradually fail to protect as time goes on. This occurs much sooner where the air is moist or full of smoke or gases than where always clear and dry. If the strength of the material underneath is to be preserved, additional protection in the form of paint, must be applied from time to time as needed. To find out when painting is needed, it is necessary to get up on the roof and examine it closely and carefully.

All steel roofing, whether galvanized or not,



Fig. 1
Tinner's Hand Snips
(straight blades)

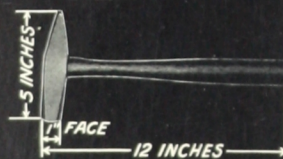


Fig. 3
Tinner's Hammer



Fig. 2
Compound Lever Shears

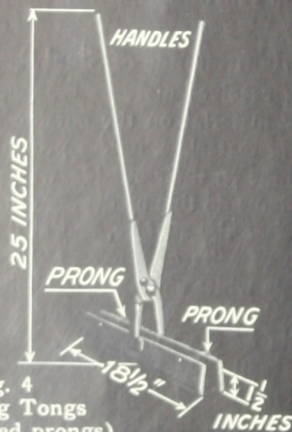


Fig. 4
Flanging Tongs
(with fixed prongs)

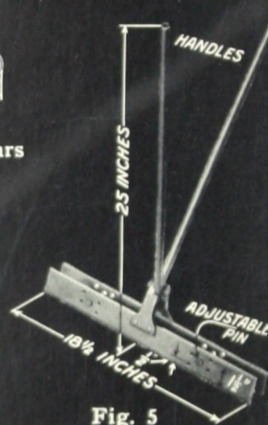


Fig. 5
Adjustable-pin Flanging Tongs



Fig. 6
Squeezing Tongs



Fig. 7
Double Seaming Tongs

should be painted. Galvanized roofing will resist corrosion for varying lengths of time depending upon climatic conditions. In very dry climates a galvanized roof might not need painting for many years. In other climates, painting might be advisable within a relatively short time after application. As a guide to those who desire to wait until painting is absolutely necessary, it is urged that this painting should not be delayed after the first least signs of rusting—that is to say, the first slightest discoloration of a yellowish or reddish-brown nature—appear on the surface of the galvanizing.

It is pointed out, however, that when galvanized roofing is painted as soon as the surface sheen is dulled, the steel has the complete and full protection of both the paint coat and the galvanizing coat. When, on the other hand, painting is delayed until the first least signs of rusting are noticeable, it must be realized that a certain large portion of the galvanizing coat has weathered away. The roof should be examined carefully every six months. At the same time, it should be noted whether the steel sheets are tight at the joints or whether the nails have drawn out in places. Leaves or other accumulations should be cleaned from the gutters, and if there are sags in the gutters they should be adjusted so that water drains away freely and quickly.

Painting Galvanized Steel Roofing

Two things are important in a paint; first, that the liquid parts, when dry, shall form a uniform water-tight skin free from pin holes or cracks, and second, that the solid parts (pigment) shall not of themselves have a corrosive action on the steel.

Use that kind of paint which to your own reliable knowledge has, in your neighborhood, given the longest perfect protection to sheet steel. If a paint which claims to be better is brought to your attention, let it prove its superior worth by actual life in a number of places. Then try it out yourself on a small building.

Three conditions are necessary before starting to paint a steel roof:

First, replace any nails that have come loose or have raised from the roofing. Do not waste time by driving them down, but take them out and substitute thicker and longer nails with plenty of barbs down near the point where the nail is hold-

ing into the solid wood. Be sure to use only heavily galvanized nails with lead washers or nails with either lead heads or mushroom-shaped galvanized steel heads.

Second, clean the roof thoroughly just before painting. If it is rusted at any point, the rust should be brushed off completely with a wire brush. Painting over rust is a waste of time.

Third, the roof surface must be absolutely dry. The weather must not be foggy or damp. After painting, the surface must have time to set before any rain falls. Do not continue painting at the approach of a rain storm and do not start painting until the morning dew has been evaporated by the sun.

If, as is generally the case, the paint is bought ready mixed, it should be well stirred so that all of the solid material which tends to settle to the bottom of the container is mixed with the more liquid portion.

Most paints prepared by reliable manufacturers should be used without addition of any thinners, unless so specified by the manufacturer, and then only with the kind of thinner specified. No kerosene or gasoline should be used in thinning paint if real paint protection is desired.

The paint must not simply be slopped on but either must be rubbed into close contact with the surface with a brush, or must be machine-sprayed against the surface forcefully enough to displace the layer of air which always hugs closely to every surface. Paint can be brushed or sprayed on either too thinly or too thickly for lasting protection.

On the average, one gallon of good oil paint will cover about 500 sq. ft. of galvanized steel roofing for the first coat. This takes for granted that the roofing is in good condition and that the paint is spread evenly. Thickness in one place does not make up for thinness in another. Every part must be thoroughly covered, leaving no brush marks or thin places. Care should be taken to work the paint into all joints.

Painting should be started at the peak of the roof generally, and carried along preferably on both sides of the roof at the same time. When the roof is too steep to walk on safely, even with rubber soled shoes, two ladders can be lashed together so that one hangs on each side of the roof across the ridge. The hook-end ladder or cleat board described in Chapter I, page 31, will serve the same purpose. The ladders are always kept on the

old or unpainted part of the roof until the roof is nearly completed, and then the painting is completed by working from ladders, the lower end of which rests on the ground with the upper end against the gable. In this way scraping paint off the finished surface is avoided. Where the paint is sprayed onto steep roofs, the work can be done from either ladders or scaffolds.

Certain parts of the sunlight have strong, penetrating chemical effects on paint, thus warranting the use of two coats rather than only one. The color of the paint, especially of the last coat, is important. In general, light colored paints let less heat into the building in summer, and let less heat out of the building in winter than do dark colored paints.

The total expense of giving a roof two coats of a good grade of paint, costing about \$3.00 a gal-

lon, will be about $13\frac{3}{4}$ cents a square foot, if sprayed on. This includes a fair allowance for the labor. The cost would be nearly twice this if the paint were brushed on.

Some orchard spray outfits can be adapted to spray paint, and the students at some of the agricultural colleges are beginning to engage in this painting as summer work. This makes it possible to have the painting done in the best season of the year. The ordinary good paint, applied as here indicated and used under fairly good conditions, will last approximately four years before repainting should be required. Cared for in this way, the roof should have practically unlimited life at an almost negligible cost. The roof should be closely inspected twice a year even if seemingly in first-class condition when viewed from the ground.



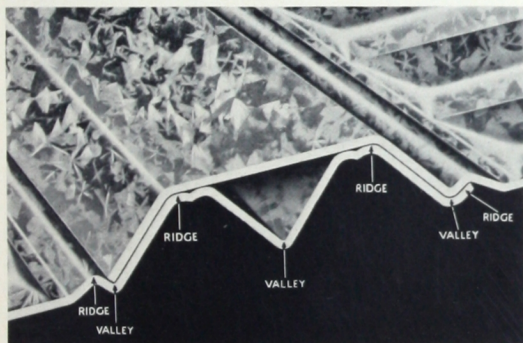
CHAPTER I-A

Triple Drain Channel Roofing

THE newest type of roofing and one which is proving most satisfactory is Triple Drain Channel Roofing, manufactured by Republic Steel Corporation.

Triple Drain represents the latest engineering thought on the handling of wind-driven rain. Three separate channels are provided for the disposal of water, as shown below. A beaded channel makes a tight fit at the overlapping edge, creating a vacuum action. Thus, any rain passing this point through the action of gravity is carried into the center channel, which is larger than that on ordinary roofing.

It should also be noticed that rib stiffeners at the end laps of the sheets provide a storm-tight edge. Triple Drain is so sturdy it will not flap in the wind.



How to Apply Triple Drain Roofing

In order to avoid any misunderstanding regarding nailing methods, blue stencilled lines indicate the exact nailing area. Nails should be staggered at intervals of every twelve inches. Galvanized lead head nails are recommended. On new applications nails should be $1\frac{1}{2}$ inches and not less than 2 inches when Triple Drain is applied over an old roof.

The question of the pitch of the roof is an important consideration. Under no circumstances should Triple Drain ever be used on roofs having less than a 6 inch rise in 1 foot. Much better re-

sults are obtained, of course, when the pitch is more than 6 inches.

The amount of end lap will vary according to the pitch of the roof. An end lap of at least 6 inches is recommended in every instance and frequently an end lap of 8 inches is advisable.

In applying Triple Drain roofing, remember that, because the covering width is exactly the same as that of V-crimped, 24 inches, the same principles govern the measurement for any roof.

The Agricultural Extension Bureau of Republic Steel Corporation will gladly send complete information regarding the correct procedure in applying roofing accessories.

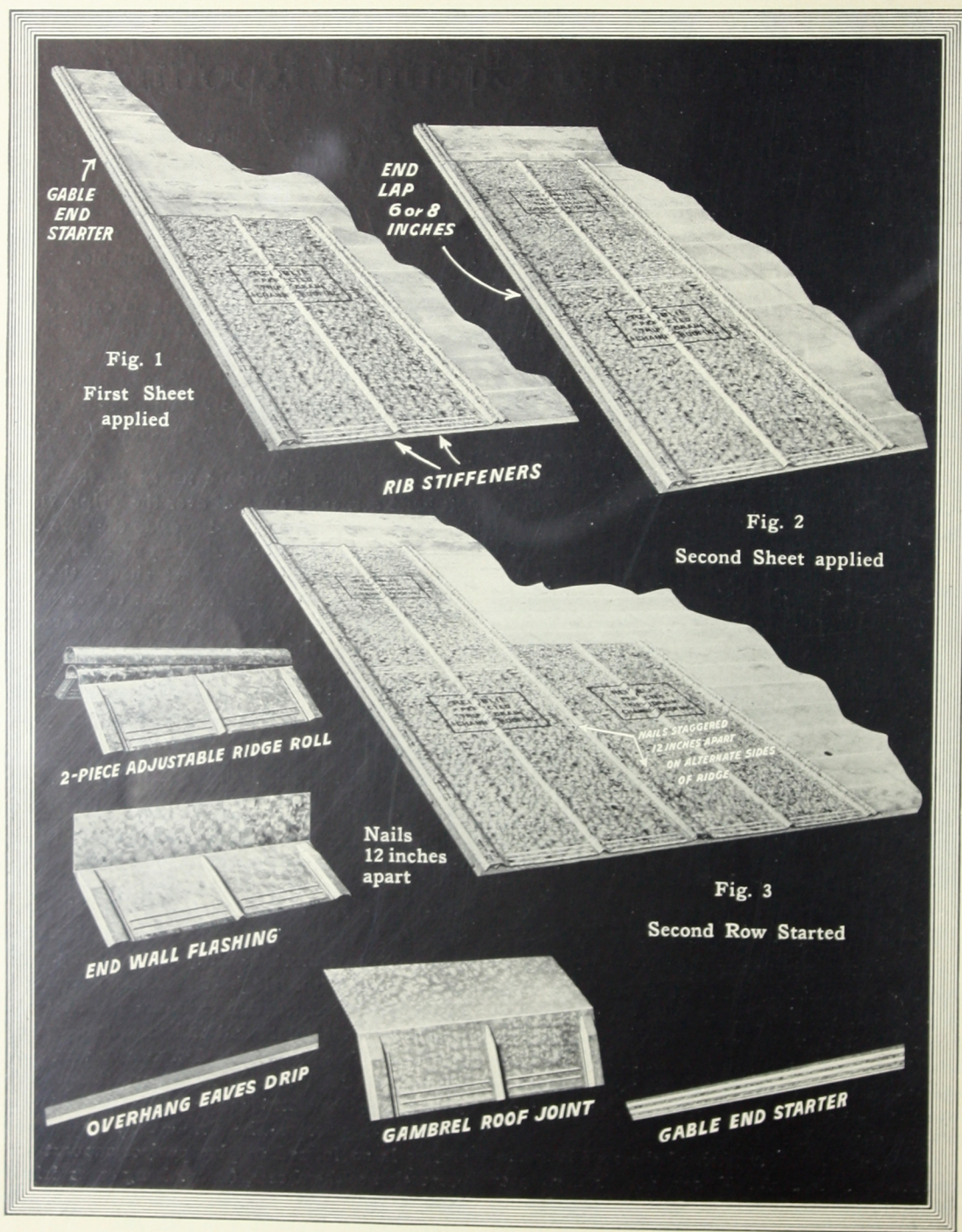
The first sheet should be nailed in the lower left hand corner of the roof over the Triple Drain gable end starter and should overlap the eave drip edge by about $1\frac{1}{2}$ inches unless an overhang eaves drip is used. The second sheet should then be nailed directly above the first sheet to overlap at the end and so on to the ridge. The second row is started, as was the first, at the eave edge being nailed into position so it overlaps the right hand side of sheet No. 1. In this manner the Triple Drain construction is preserved at every point where one sheet overlaps another.

Accessories Are Available

A complete line of special accessories for the Triple Drain type of roofing is available and their use is always recommended.

A two-piece ridge roll has been designed especially for Triple Drain roofs. This is adjustable to roofs of varying slopes and the two pieces are easily fitted without bending or malleting. The apron ends of the ridge roll conform with the Triple Drain construction to assure a compact fit.

Gambrel roof joints and end wall flashings recently have been especially designed and now are available in the Triple Drain construction. Ample aprons have been provided and do their full part in preventing leaks. The Triple Drain gable end starter is so formed to give perfect support and protection to the sheets. An overhang eaves drip is another important Triple Drain accessory. All accessories are illustrated on page 38b.



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CHAPTER II

Corrugated Roofing

How to Measure for Corrugated Roofing



SING a measuring stick rather than a tape that may stretch, measure the length of a shed roof along either eave, as shown in Fig. 1, page 22. Allow 2 inches at each end of the eave, or a total of 4 inches for both ends, to be turned down over the edge of each gable. Then make this length equal to the next higher even numbered foot.

For example, the true eave length may be 31 ft. 3 ins. which, by adding the 4 inches for both ends, makes 31 ft. 7 ins. Instead of using this figure, use the next even numbered foot higher or 32 feet. Divide this length by 2 feet (the net covering width of each $27\frac{1}{2}$ -inch sheet) and the result is sixteen, which means that this roof will require sixteen sheets of roofing in width.

If $27\frac{1}{2}$ -inch wide sheets of $2\frac{1}{2}$ -inch corrugations, providing a net exposed covering width of 2 feet, are not available, and it becomes necessary to use sheets 26 inches wide with a net exposed covering width of only $22\frac{1}{2}$ inches, the figuring is slightly changed. The correct result may be arrived at by converting the entire eave length into inches and dividing this number by $22\frac{1}{2}$.

Where $1\frac{1}{4}$ -inch corrugated sheets, 26 inches wide, are used, they are lapped $1\frac{1}{2}$ corrugations and still provide a net exposed covering width of an even 2 feet because of the smaller corrugations.

For another example take a roof with a true eave length of 50 ft. 2 ins. Adding 4 inches to permit a 2-inch drip edge at each gable end, gives a total of 50 ft. 6 ins. The next highest even numbered foot would be 52 feet and the job would therefore call for twenty-six sheets if $27\frac{1}{2}$ -inch wide roofing were being used. The overhang of the last row of sheets up and down the roof would permit cutting the sheet in half from end to end.

Note that the width of the sheet goes across the roof while the length runs up and down from the eave to the ridge, or top.

Now measure the length of the slope from the low eave to the high eave and allow 2 inches at each eave for drip edge.

Suppose we have a shed roof, such as on the calf shelter shown in Fig. 1, page 22, that measures 9 ft. 5 ins. long on the slope which, by adding the 2 inches at each of the eaves, makes 9 ft. 9 ins. This requires a 10-foot sheet. The extra 3 inches can project out over the top edge of the shelter or be bent down slightly to make a drip edge which will serve to better shed the rain water.

Thus the roof of this calf shelter, which measures 31 ft. 3 ins. long by 9 ft. 5 ins. on the slope requires sixteen sheets of $2\frac{1}{2}$ -inch Corrugated galvanized roofing, $27\frac{1}{2}$ inches wide by 10 feet long in No. 28 gauge (or heavier), as shown in Fig 1, page 40.

For another example, suppose the roof to be covered is a shed roof that measures the same 31 ft. 4 ins. along the eave, but measures 24 ft. 1 in. on the slope from the eave to the top. First determine how many courses of sheets are needed.

If sheets only 5 feet long were used, it would take about five courses. This would mean four end joints and laps which would be unnecessarily many. It would be better to use longer sheets, say 8 or 10 feet long, with fewer laps. The end laps of sheets should be not less than 4 inches for steep roofs. (Although Corrugated roofing is not recommended for flat slopes, it is sometimes so used. When this is the case it is considered necessary to seal the end and side laps with a water-proofing paste paint as described later in this chapter.) Three sheets up this roof will give two laps on the middle course. Allowing 4 inches for each of two laps and 2 inches for each eave projection, it is necessary to add 4 inches plus 4 inches plus 2 inches plus 2 inches or 12 inches to the slope length of 24 ft. 1 in., which makes a total of 25 ft. 1 in.

By using two sheets 10 feet long and one sheet



Fig. 1
One Sheet or Course from Low Eave to High Eave



Fig. 2
Four Courses from Eave to Ridge



Fig. 3
Five Courses from Eave to Ridge

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5 feet long the 1 inch that is lacking can be divided between the two joints and the eave projections, keeping the joints or laps as close to 4 inches as possible. This would be close fitting on the job.

The total number of sheets for this roof would then be figured as follows:

16 (Number of sheets in width) x 2 (number of courses) or 32 sheets, 10 feet long.

16 (Number of sheets in width) x 1 (the top course) or 16 sheets, 5 feet long.

Most dealers carry the different lengths in stock. In case the dealer did not have the 5-foot lengths, 8 sheets 10 feet long could be purchased and cut in half with a pair of tinner's snips or shears, thus making the sixteen pieces 5 feet long.

The bill of material for this shed roof therefore, would be either:

32 sheets of 2½-inch Corrugated galvanized roofing, 27½ inches wide, 10 feet long, 28 gauge (or heavier) and 16 sheets of the same material 5 feet long, or;

40 sheets, same material, all 10 feet long, 8 of the sheets to be cut to 5-foot lengths.

If this were one side of a ridge roof, it would be necessary only to double the bill of material for the entire roof.

On roofs of medium slope where strong winds might blow the rain or snow between the end laps, a more liberal estimate should be made to provide longer laps. Two 10-foot sheets and one 6-foot sheet on the top course would give a total of 26 feet of sheets to cover 24 ft. 1 in. plus the 2-inch overhang at each eave or 24 ft. 5 ins. This would leave 1 ft. 7 ins., or 19 inches for the two joints, making 9½ inches for each joint or lap. This would result in an extra good job.

Following such a plan the material required for this part of the roof would be:

32 sheets of 2½-inch Corrugated galvanized roofing, 27½ inches wide, 10 feet long, 28 gauge (or heavier) and 16 sheets same material, 6 feet long.

If the dealer carried a large stock of 8-foot sheets and fewer other sizes, another combination could be used that would provide the same number of square feet. Using the 10-foot sheet for the eave course and two courses of 8-foot sheets toward the top, would provide the necessary 26-foot length of sheets. Using such a combination, the material required would be:

16 sheets of 2½-inch Corrugated galvanized roofing 27½ inches wide, 10 feet long, 28 gauge (or heavier) and 32 sheets, same material 8 feet long.

Figure 2, page 40, shows a ridge roof barn covered with four courses of sheets on one slope. Figure 3, page 40, shows another ridge roof barn covered with five courses on one slope which has a broken pitch.

From these examples it is seen that the proper combination of galvanized sheets can easily be figured for any roof no matter what lengths of sheets the dealer has in stock. Moreover, this is based upon ready cut sizes. When required, any person can easily cut the sheets to fit any special case.

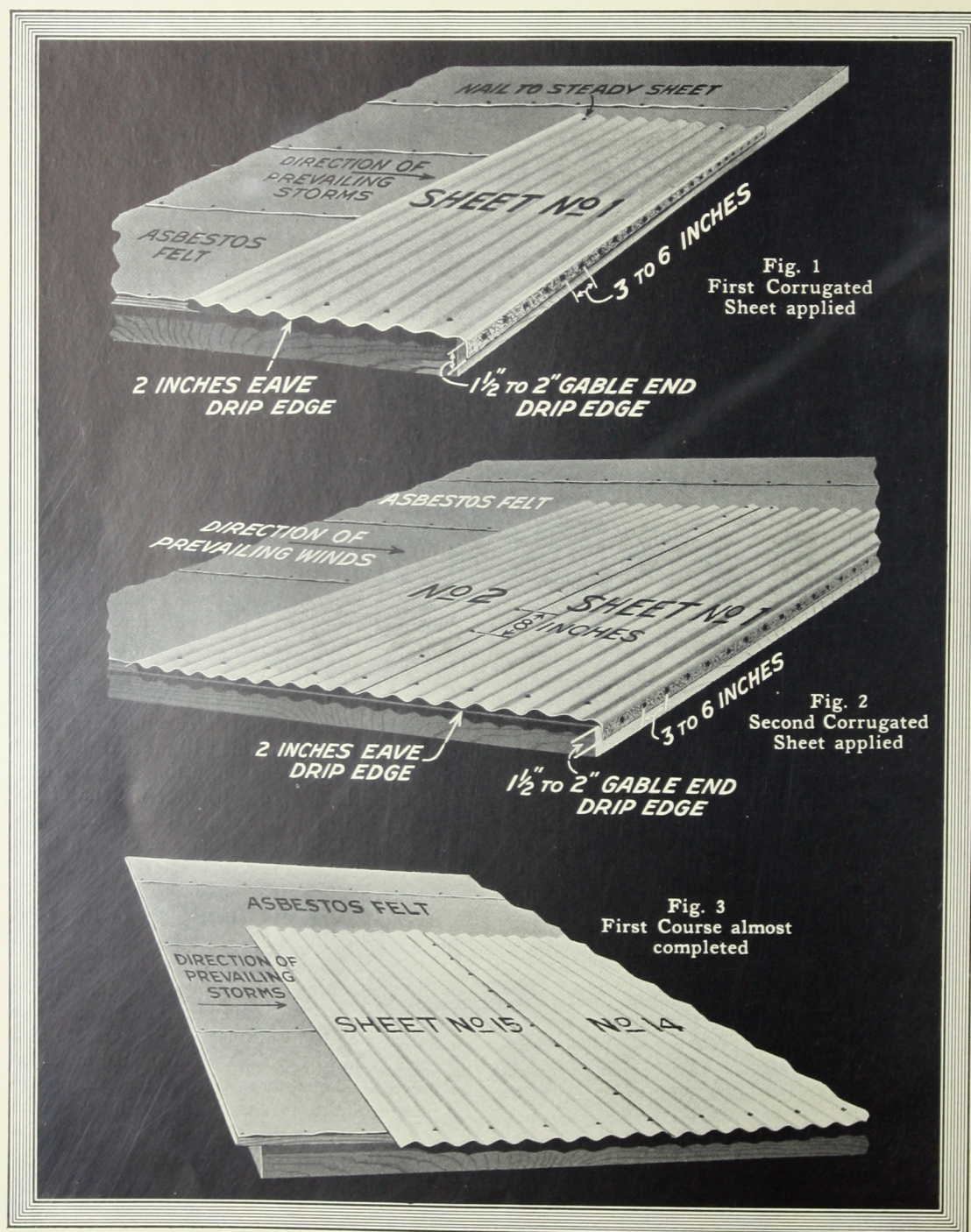
How to Lay Corrugated Roofing

To apply either 2½-inch or 1¼-inch corrugated sheet steel to a roof that has been measured and found true, lay the first sheet at the lower corner on the side away from prevailing storms, as explained before. Place that side of the sheet which has the corrugation turned down, to the end of the roof. Permit this side edge to project one corrugation over the roof boards at the gable end, and the bottom edge 2 inches over the eave.

With this first sheet in its correct position, with the corrugations straight up and down the roof as shown in Fig. 1, page 42, drive two nails in its extreme upper end several corrugations apart and one in the bottom end. This will prevent the sheet from slipping while the projecting side corrugation is being hammered down over the end of the gable. Then nail the drip edge securely, using galvanized nails 1¾ inches long, and spacing these nails 5 to 6 inches apart or greater as conditions or judgment warrants.

Now nail across the sheet close to the eave, driving the nails through the top—not the bottom—of every other or alternate corrugation. In short, nail the first corrugation, skip the second, nail the third, skip the fourth, and so on. The heads of the nails should be tight against the washers. Do not, however, indent or crush the corrugated metal by driving the nails too far into the wood. In applying sheets of the heavier gauges, nailing can be made easier by using a sharp punch to start the hole.

Before further nailing, lay the second sheet side by side with the first, lap it over the first sheet 1½ corrugations as shown in Fig. 3, page 18, and



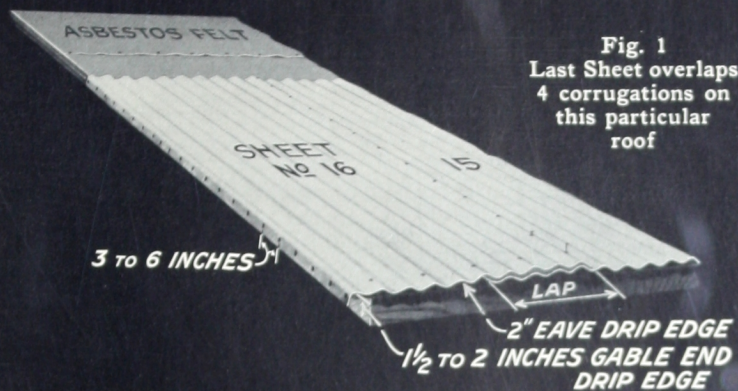


Fig. 1
Last Sheet overlaps
4 corrugations on
this particular
roof

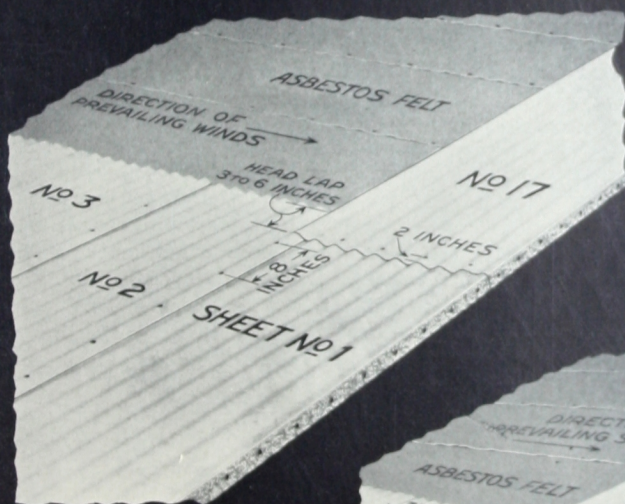
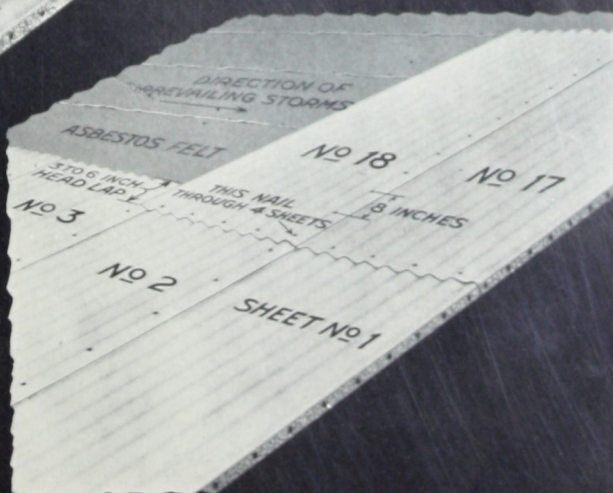


Fig. 2
First Corrugated
Sheet in Second
Course applied

Fig. 3
Second Corrugated
Sheet in Second
Course applied



with the same amount of eave projection. Nail the two sheets through this lap or two thicknesses of metal, driving the nails straight into and through the tops of the corrugations. These nails in the side laps of sheets should be about 8 inches apart, as shown in Fig. 2, page 42.

The first sheet has now been nailed on the outside edge, the bottom edge along the eave, and the inside edge with the lap of sheet No. 2. This leaves the top edge with only two nails in it for the present, but it will be nailed more securely when the second row or course of sheets is laid later. It is not necessary to drive any nails in the body of any sheet. Nailing on the two sides and two ends is sufficient. Next, drive a nail in the top of alternate corrugations of sheet No. 2 across the eave as was done with the first sheet.

Continue with the third and remaining sheets in the same manner until the first row or course is completed across the full length of the roof. It may happen that this length is such that the last sheet does not come out exactly even in width, as shown in Fig. 3, page 42. In this case, the easiest and quickest way to lay the last sheet (No. 16) would be to move the sheet over and lap it into the corrugations of sheet No. 15, until the outside edge can be turned down over the gable end, to form a drip edge like that provided with sheet No. 1. This may result in 4 corrugations lap, as shown in Fig. 1, page 43, instead of $1\frac{1}{2}$ corrugations as on all other side laps.

Nail along the side lap of the last sheet through the top of the corrugation nearest the extreme inner edge, the nail going through two thicknesses of metal similar to the other laps. Nail along the eave next and finally along the drip edge over the end of the gable.

It may happen that the last sheet is needed to cover only 6 inches or less of exposed roof deck. In this case, the sheet may be cut lengthwise into two pieces. This half piece would then give the necessary $1\frac{1}{2}$ corrugations side lap and still be wide enough for the drip edge over the gable end.

The second row or course of sheets is applied in the same order as the first row, beginning at the same end as with sheet No. 1 of the first row. This first sheet in the second row (No. 17) should have the same side drip edge as sheet No. 1 of the first row and should lap down over the first row of sheets 3 to 6 inches, according to the slope of the roof. See Fig. 2, page 43.

Nail the drip edge first, making sure again that the sheet is square with the building and the corrugations are straight up and down the roof. Nail next across the bottom of this sheet, driving the nails through the top of every other corrugation as on the first course except that in this case, the nail is about 2 inches up from the bottom end of sheet No. 17 and it goes through two thicknesses of metal.

The second sheet in this row, sheet No. 18, is side-lapped $1\frac{1}{2}$ corrugations over sheet No. 17 and is end-lapped the same as sheet No. 17, so that the bottom ends are in a straight line as shown in Fig. 3, page 43. Sheet No. 17 and all the other sheets in this row are nailed along the side and bottom ends the same as the first row, except that one nail must now go through four thicknesses of metal where the two sheets in each of the upper and lower rows come together. Here a sharp punch will come in handy to start the holes. Complete this course across the roof and proceed with the remaining course or courses in the same manner.

How to Finish the Ridge

Where the roofing sheets on one side or slope of a roof join at the top with those on the other side, this part of the roof, called the ridge, should be water-tight. The old style of application consisted of placing the sheets on one side of the ridge flush or even with the ridge line, then letting the sheets from the other side project 3 or 4 inches beyond the ridge, then bending this projection over the ridge and nailing along the end of the sheet. This is not the best way and is not recommended because such bending may damage the galvanized coating.

The best finish is obtained by the use of a ridge roll. There are several styles of ridge finish that are made in the factory. These save time in application, insure the water-tight job desired above everything else and improve the appearance of the completed roof. The most common type is the plain ridge roll with nailing flange as shown in Fig. 1, page 45, which also shows the location of the nails.

The most common size of plain galvanized ridge roll used is 2-inch diameter of roll with 10-inch girth. It comes in stock lengths of 8 and 10 feet and usually is of No. 26 gauge. Figure 2, page 45, shows this plain ridge roll applied to Corrugated roofing.



Fig. 1
Plain Ridge Roll with
Nailing Flange



Fig. 3
2 1/2-inch Corrugated
Ridge Roll

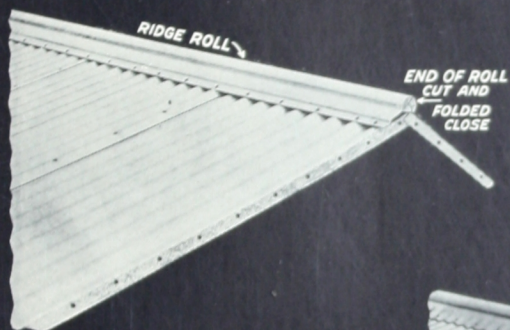


Fig. 2
Plain Ridge Roll applied to
Corrugated Roofing

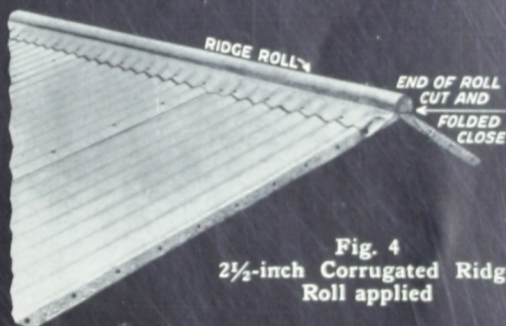


Fig. 4
2 1/2-inch Corrugated Ridge
Roll applied



Fig. 5
Block Finial for
Roof Ornamentation

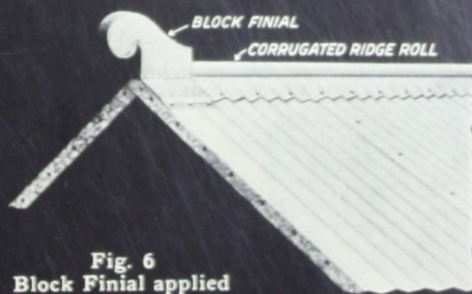


Fig. 6
Block Finial applied



Fig. 4
Gambrel Roof Eave Joint



Fig. 2. Gambrel Roof with Flared Eaves

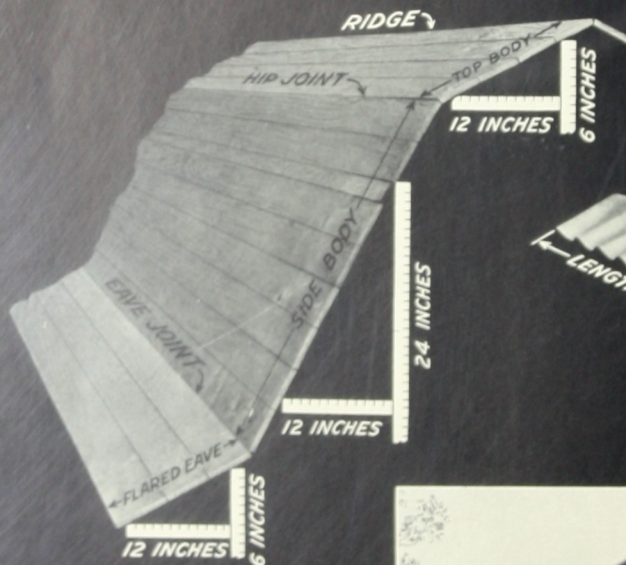


Fig. 1
Gambrel Roof Deck



Fig. 5
Gambrel Roof Hip Joint



Fig. 3. Gambrel Roof with Straight Eaves

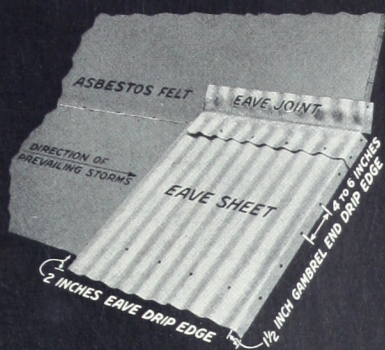


Fig. 1
First Sheet and Eave Joint
applied on Gambrel Roof

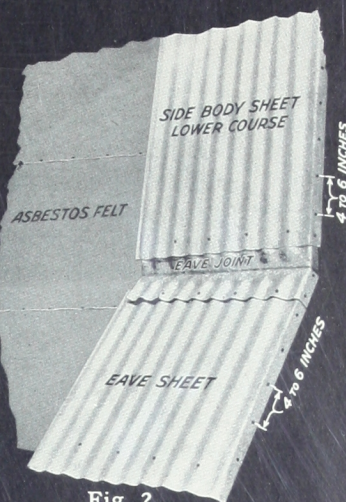


Fig. 2
First Sheet applied above Eave Joint
on Gambrel Roof

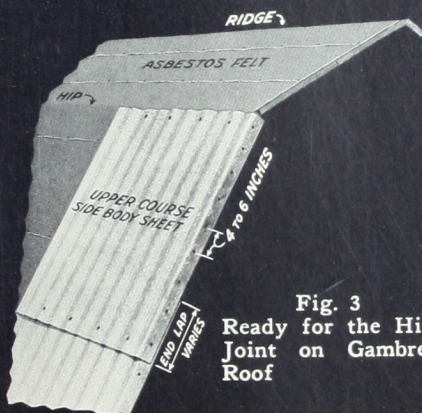


Fig. 3
Ready for the Hip
Joint on Gambrel
Roof

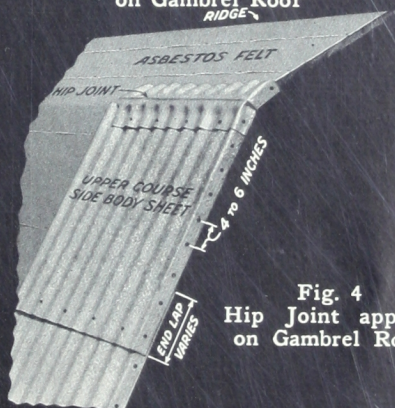


Fig. 4
Hip Joint applied
on Gambrel Roof

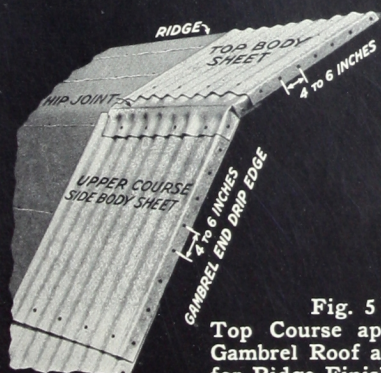


Fig. 5
Top Course applied
on Gambrel Roof and ready
for Ridge Finish

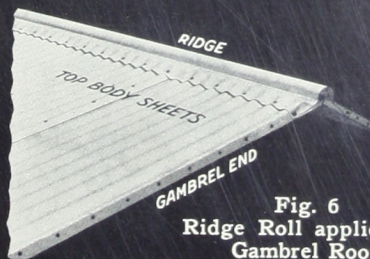


Fig. 6
Ridge Roll applied
on Gambrel Roof

There is another style of ridge roll for use with Corrugated roofing sheets which is called Corrugated Ridge Roll as shown in Fig. 3, page 45.

The two common sizes of galvanized corrugated ridge roll, either with $2\frac{1}{2}$ -inch or $1\frac{1}{4}$ -inch corrugations, are 12-inch girth and 14-inch girth, and in stock lengths of 8 and 10 feet, usually No. 26 gauge. Figure 4, page 45, shows this corrugated ridge roll applied to Corrugated roofing.

With all ridge finishes, an allowance of 3 inches should be made at every end lap.

Figure 5, page 45, shows a block finial which is one of many designs of ornaments to be used on the ends of the ridge. This finial fits a 2-inch ridge roll and is formed with a nailing flange. The location of the nails is indicated on the flange in the illustration. Figure 6, page 45, shows this finial applied to the gable end of the corrugated ridge roll.

Making Joints Waterproof

Where, due to mistaken judgment, Corrugated roofing has been applied on too flat a slope, it may be found desirable to waterproof the side and end laps. Such waterproofing will prevent the slightest leakage during those occasional storms when, because of unusually high winds, the rain might be driven under the laps. This would not occur on roofs of proper slope and with the laps facing away from the origin of prevailing storms.

An effective waterproofing is obtained by the use of a paste paint composed of a pigment variously known as "dry oxide of iron" or "Venetian Red," and raw linseed oil. Do not use compounds in which coal tar has been used as a solvent because the acid in the tar injures the steel. A good waterproofing paste can be made at home by thoroughly mixing 30 pounds of iron oxide or "Venetian Red" and one gallon of raw linseed oil. These amounts will make four and one-third gallons of paste paint ready for use. When this is thoroughly mixed to a smooth, creamy consistency it will cover from 900 to 1000 lineal feet of joint if the paste is applied in a ribbon about $\frac{1}{2}$ inch wide by $\frac{1}{8}$ inch thick. One easy way of applying paste paint is to put a quantity into a bag made of canvas or oil cloth. A small hole is made in one corner of the bag and the paste may be squeezed from this hole in a small and continuous stream.

Keep the paste back from the edge of the joint so that none is squeezed out and left exposed.

How to Lay Corrugated Sheets on a Gambrel Roof

Figure 1, page 46, shows a close-up view of the gable end of a gambrel roof barn with flared eaves similar to the roof shown in Fig. 2, page 46. This view clearly shows the flared eave, eave joint, body, hip joint and ridge. Some barns have a straight eave, as seen in Fig. 3, page 46.

Figure 4, page 46, shows the corrugated gambrel roof eave joint, as manufactured for this purpose. It is made in short sections, 26 inches long, $8\frac{1}{2}$ -inch girth with $2\frac{1}{2}$ inch or $1\frac{1}{4}$ -inch corrugations to fit the style of Corrugated roofing used on the main body of the roof. The eave joint, when turned over, serves for use as the hip joint, as shown in Fig. 5, page 46. Because the eave joint may retain moisture for longer periods than the steeper body of the roof, it should be of a gauge the next heavier than sheets used on the body of the roof. For instance, No. 26 gauge gambrel joints should be used with No. 28 gauge roofing sheets.

The starting point with a gambrel roof is governed by the direction of the prevailing storms as previously described. Assume it is decided to start at the lower right-hand corner of the roof. Figure 1, page 47, shows the first or eave starter sheet, which has the same 2-inch eave drip edge and $1\frac{1}{2}$ -inch gable end drip edge common to other roofs. This sheet is long enough to fit neatly in the angle of the eave joint. Nails in the edge are spaced 4 to 6 inches apart. The eave is nailed at the top of every second corrugation as with other roofs. The corrugated gambrel roof joint is then fitted over the eave sheet and nailed near the bottom edge through every second corrugation as shown. The projecting end is snipped and bent down to form the gable drip edge.

The starter sheet of the first course of side body sheets is now fitted over the corrugated gambrel joint as shown in Fig. 2, page 47. One or two nails can be driven through the extreme top edge to prevent the sheet from slipping down. Now bend over and nail the drip edge, lastly nailing the bottom through every other corrugation.

The starter sheet of the upper course of side body sheets is then fitted over the lower course, having the upper end even with the hip joint as shown in Fig. 3, page 47. The extreme upper end may be nailed to prevent slipping. The gable drip edge is nailed as before mentioned. The lap of the



Fig. 1. This cottage illustrates the proper finish for Hips and Valleys when Corrugated Roofing is used.

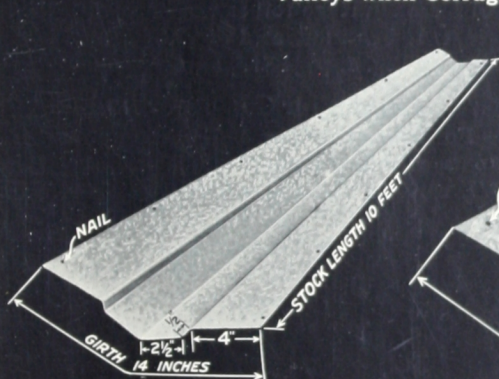


Fig. 2. A length of Formed Valley showing 14-inch girth

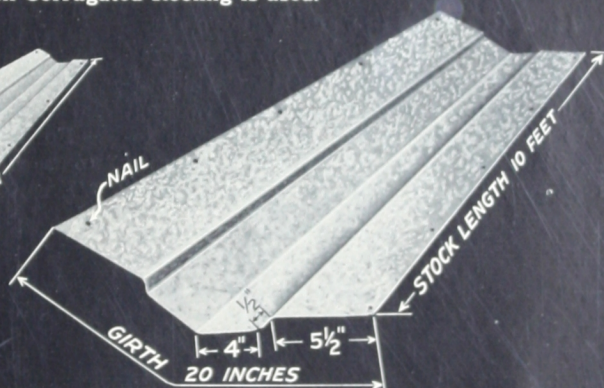


Fig. 3. A length of Formed Valley showing 20-inch girth

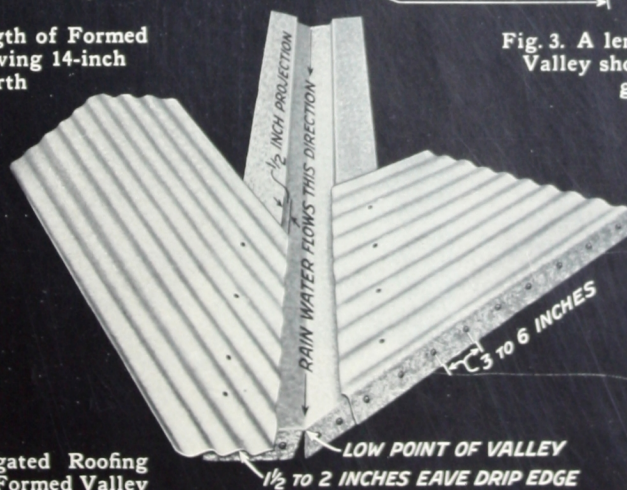


Fig. 4. Corrugated Roofing applied with Formed Valley

bottom end over the top of the lower course will vary with the choice of length of sheets made for this side. Now nail the bottom end.

The gambrel joint is now fitted over the hip joint and nailed along the bottom edge as shown in Fig. 4, page 47. The drip edge is cut and the top edge folded over the bottom edge. The starter sheet of the lower course of top body sheets is next applied over the gambrel joint as shown in Fig. 5, page 47. The drip edge is nailed and then the bottom end. If the top body section takes more than one course of sheets, then the upper courses are applied in the regular way. The ridge may have either a plain or corrugated ridge roll applied as previously explained, and as shown in Figs. 1 or 3, page 45.

How to Roof Hips and Valleys

Figures 2, page 49, shows a narrow formed galvanized "valley" and Fig. 3, page 49, a wide valley for use under the main roofing where two roof surfaces of a different plane or slope come together. Since the valleys, of a flatter slope than the roof, may remain moist for longer periods,

they should be of steel one or two gauges heavier than the rest of the roofing. No. 24 or No. 26 gauge valleys are suitable for use with No. 28 gauge roofing. Note that when first applied to the roof, the valley is nailed occasionally at the back edge of the nailing flange. The Corrugated roofing is cut on the diagonal as shown in Fig. 4, page 49, so as to fit it close along the line of the break or offset into the valley. The nails are driven through the roofing so as to come near the back edge of the nailing flange.

In contrast to a valley, a "hip" is the high edge formed by the intersection of two roof surfaces. It is a sort of secondary ridge. Here the main roofing sheets should be cut on the diagonal so as to fit closely to the hip itself. Then cover this joint with a plain ridge roll as was done with the main ridge, and as illustrated over the square bay window in Fig. 1, page 49.

Flashing for Corrugated Roofing

For information concerning the proper flashing to use with Corrugated roofing, please see Chapter VI, entitled, "Galvanized Steel Flashing."



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CHAPTER III

V-Crimp Roofing

How to Measure for V-Crimp Roofing

WITH V-crimp roofing it is necessary to use three-sided wood strips under the side nailing crimps to provide a solid nailing joint. It is not necessary to put strips under or nails in the middle "V" of 3 V-crimp or 5 V-crimp roofing. The strips under the side nailing crimps serve to firmly brace the sheet. Always order the wood strips shipped with the roofing, as it is essential that they fit the V-crimp perfectly. Strips purchased elsewhere may vary in size and fail to give the same satisfactory results. The wood strips are not included with the steel and must be ordered extra.

V-crimp roofing usually is laid one width or row at a time from the eave to the ridge. Suppose it is planned to cover the shed roof shown in Fig. 1, page 22, with 3 V-crimp roofing. The measured size of this shed is 31 ft. 3 ins. along the high eave and 9 ft. 5 ins. along the slope. Since V-crimp roofing sheets cover 2 feet in width, sixteen sheets will be required to cover this shed. Each sheet should be the next full foot in length, or 10 feet long. It must be remembered that each joint in each course of V-crimp roofing requires one wood strip as long as the sheet. There is always one less joint in each course than there is number of sheets.

This shed roof, therefore, would require the following bill of material:

- 16 sheets galvanized 3 V-crimp roofing, 10 feet long, 28 gauge (or heavier).
- 15 pieces V wood sticks, each 10 feet long.

How to Lay 2 V-Crimp or 3 V-Crimp Sheets

The starting point on the roof with V-crimp roofing as with other types discussed in this book, depends upon the direction of the prevailing storms as explained on page 17. It will be necessary to borrow, rent or buy a pair of flanging tongs, in addition to a pair of tinner's hand

shears, commonly called "snips." If flanging tongs are not easily obtainable the flanges can be formed readily by bending the edges over a straight piece of wood.

Nails should be $1\frac{3}{4}$ inches or 2 inches long and of the barbed, galvanized type. The nails are driven through the steel and the wood strips into the sheathing underneath.

Figure 1, page 52, shows sheet No. 1 with the necessary cuts made and all ready for application. This starting sheet is prepared as follows:

Flatten the V-crimp along one edge ("V" No. 1) and mark a line $1\frac{1}{4}$ inches from this edge to indicate where the sheet should be turned down to form the drip over the end of the gable.

Mark a line $1\frac{1}{2}$ inches back from one end of the sheet to indicate the amount necessary for the drip over the edge of the eave.

Next, with a pair of tinner's snips, make cuts Nos. 1, 2, 3, 4 and 5 along the bottom edge of the sheet as shown in Fig. 1, page 52.

Next, snip the top end of the sheet on the slant, as illustrated, to form the $\frac{3}{4}$ -inch end-lock flange used to attach the lower sheet in a weather-proof manner to the corresponding sheet in the next course above.

With flanging tongs, or a straight piece of wood, bend down the gable drip edge, folding the corner (A) under.

Now bend down the side tab (B), then the other side tab (C) on the side nearest the prevailing storms. Then bend down the eave drip edges (E) and (E).

Nail first the gable drip edge as shown in Fig. 2, page 52, with galvanized nails, spacing the nails from 2 inches to 3 inches apart. Nails for either the gable end or eave drip edges need be only 1 inch long. Nail the eave drip edge in the same manner as the edge of the gable end, again spacing the nails 2 inches to 3 inches apart.

Fig. 1
Starter Sheet of 3 V-
Crimp Roofing showing
cuts before application

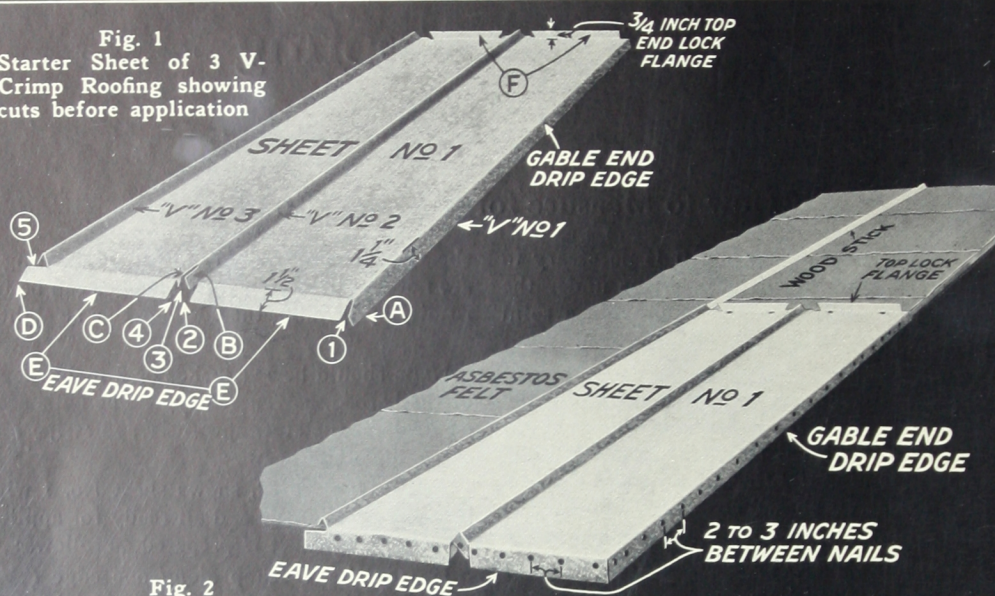


Fig. 2
Starter Sheet applied

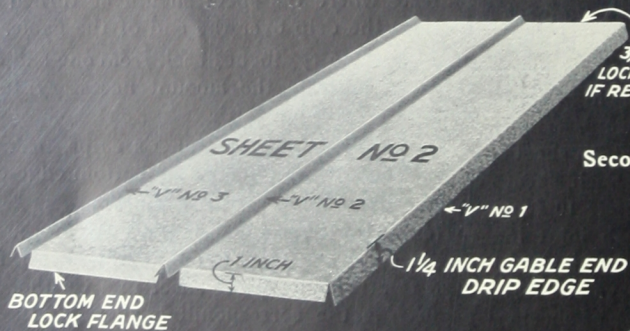


Fig. 3
Second Sheet in first row showing
cuts before application

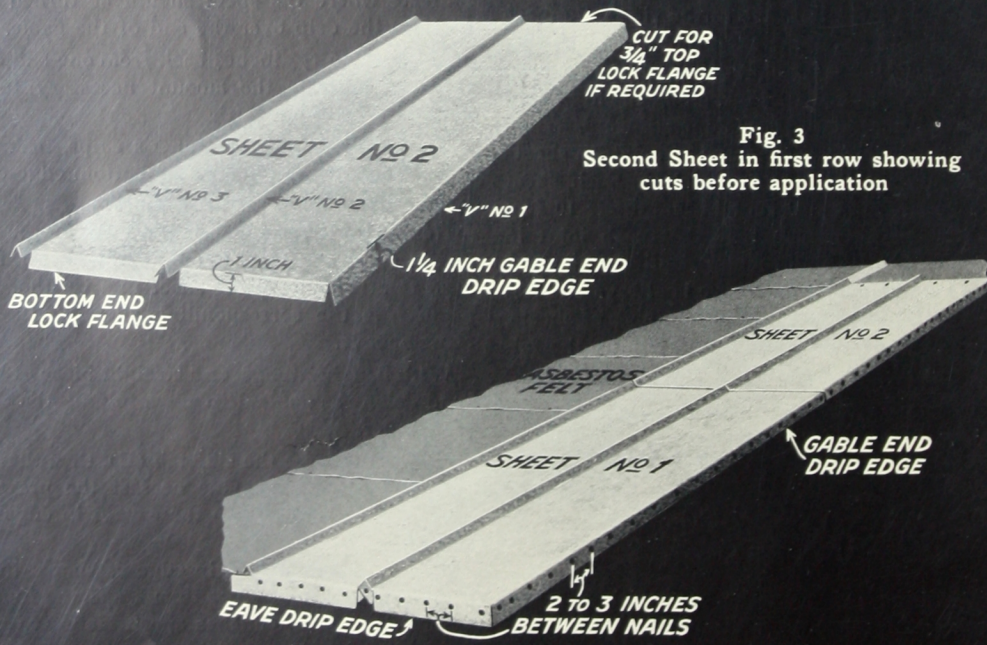
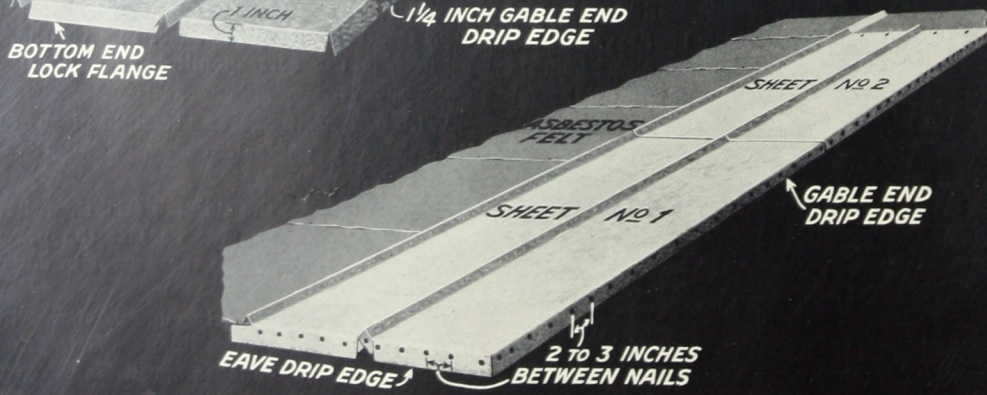


Fig. 4. Second Sheet in first row applied



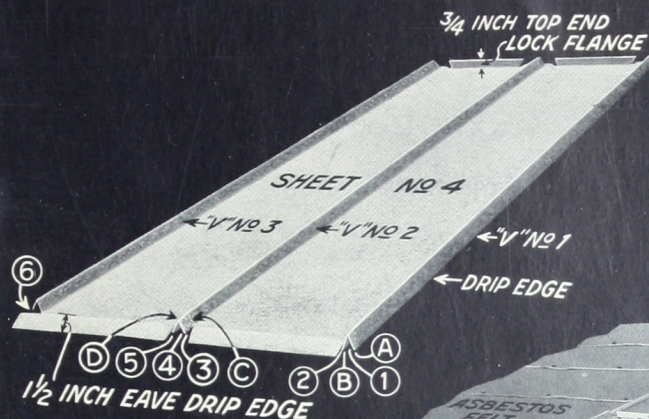


Fig. 1
First Sheet of second row of
3 V-Crimp Roofing showing cuts
before application

Fig. 2
First Sheet in second row
applied

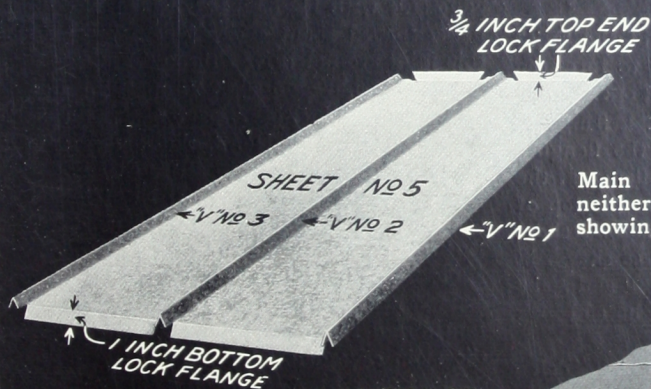
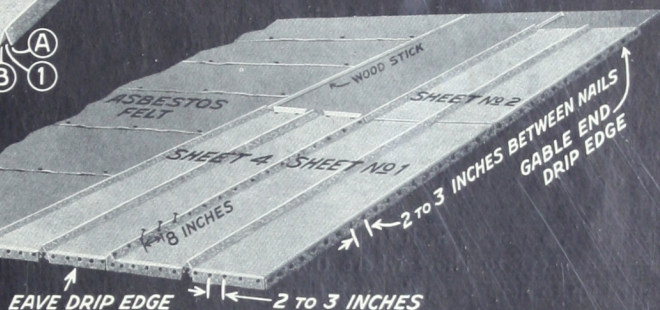
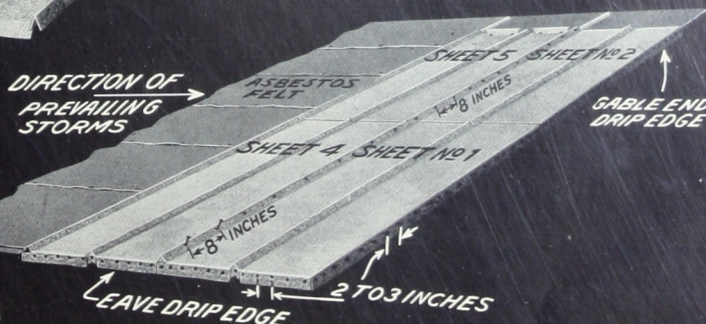


Fig. 3
Main Body Sheet (touching
neither eave nor gable end)
showing cuts before application

Fig. 4
Main Body Sheet applied



Finally, drive two galvanized nails, 1 inch long, under each end of the lock seam flange, at the upper end of the sheet as shown, and bend the lock flange forward and down almost flat.

No nails are driven in the free edge of this first sheet yet. This edge will be fastened later as the job progresses.

The job is now ready for the second sheet. In the case of V-crimp roofing the sheets are laid one width or row at a time up the roof from the eave to the ridge. Figure 3, page 52, shows the second sheet with the necessary cuts made, which are as follows:

Flatten the V-crimp along one edge and mark the line $1\frac{1}{4}$ inches in from this edge to indicate where the sheet should be turned down over the gable end, just as was done with the first sheet.

Next, mark a line 1 inch from the bottom end of the sheet to indicate where this end should be turned down to lock into the upper end of the first sheet.

Next, mark a line $\frac{3}{4}$ inch from the top end of this second sheet to show where this end must be turned up to help form the lock flange if more than two sheets are required to reach up to the ridge.

Snip along only the bottom edge of the "V's" at the lower end of the second sheet to form the joint which locks this sheet to the first one.

Make the diagonal cuts for the lock flange at the top of the second sheet. With the flanging tongs bend down and under the lock flange at the bottom and bend up the lock flange at the top of the sheet. Place the bottom of the second sheet over the upper end of the first sheet as shown in Fig. 4, page 52, so that the "V" joints fit and make a straight line up the roof. See that the end lock flanges hook together.

While holding the lower end seam tight, drive two nails under the end lock flange at the upper end of sheet No. 2 to prevent it from sliding down the roof. With a hammer or wood mallet, flatten the lower end lock seam so that it makes a smooth joint. Now nail the edge that hangs over the gable, spacing the nails 2 inches to 3 inches apart as before. Do not drive any exposed nails in any of the cross seams.

If the roof is large enough to require three or more sheets from the eave to ridge, then all the following sheets in this first width are cut and applied the same as sheet No. 2, except that the

sheet which touches the ridge needs no top lock flange.

Assume it takes three sheets from the eave to the ridge. After laying the third sheet reaching to the ridge, start the next width with sheet No. 4, as shown in Fig. 1, page 53. Mark a line $1\frac{1}{2}$ inches along the end to indicate the amount to be turned down for the eave drip edge. Make the cuts Nos. 1, 2, 3, 4, 5 and 6 at the bottom of the sheet as shown. Make the diagonal cuts for the top end lock flange of this fourth sheet.

Next lift up the free inside edge of sheet No. 1 and put one of the triangular wooden strips under the V-crimp marked No. 3 in Fig. 1, page 52. No wood strip is needed under the middle "V." The lower ends of all sticks should be flush with the edge of the eave.

Fit "V" No. 1 of sheet No. 4 over the top of "V" No. 3, of sheet No. 1 so that the eave drip edges are on the same line as shown in Fig. 2, page 53. Drive two nails under the top end lock flange of sheet No. 4 to keep it from slipping down the roof.

The overlapping side ("V" No. 1) of sheet No. 4 is nailed near the top of the "V" on the free edge side with $1\frac{3}{4}$ -inch galvanized barbed roofing nails, spaced about every 8 inches. The nails in this joint are not driven through the top of ridge of the "V," but on a slant through the side of the "V" as shown in Fig. 2, page 53. They fasten the first edge of sheet No. 4, the last edge of sheet No. 1 and the wood strip all to the roof deck.

The square tab (D) of sheet No. 1 is now lifted out so that the two tabs (A) and (B) of "V" No. 1 of sheet No. 4 are folded down on the eave drip edge. Then the square tab is nailed in place to make a neat job. The other tabs (C) and (D) are folded as described in laying sheet No. 1 and then the main eave drip edge is nailed in place.

Figure 3, page 53 shows the cuts in sheet No. 5 which is termed the first "main body" sheet because it touches neither eave nor gable end. Sheet No. 5 is locked with sheet No. 4 by means of the end lock flanges, as shown in Fig. 4, page 53. The overlapping side of sheet No. 5 is fastened with nails on the slant as in the case of sheet No. 4.

Sheet No. 6 is handled similar to sheet No. 5. The wood sticks are cut off even or flush with the top of the ridge. Proceed with all other widths in the same manner. The last width on this slope is trimmed along the gable-end drip edge the same as sheets Nos. 1, 2 and 3.

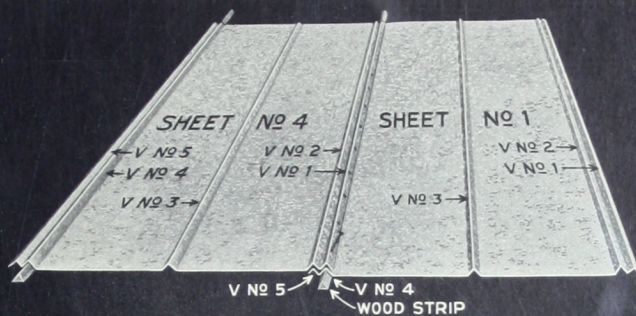


Fig. 1
5 V-Crimp Roofing showing Wood Strips, Side Lapping
and Direction of Nails

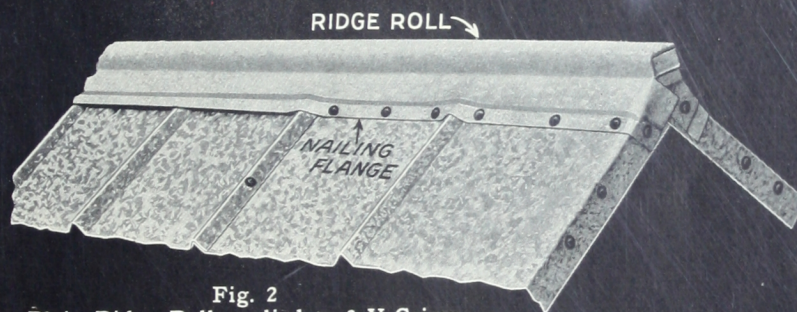


Fig. 2
Plain Ridge Roll applied to 3 V-Crimp
(or 5 V-Crimp) Roofing

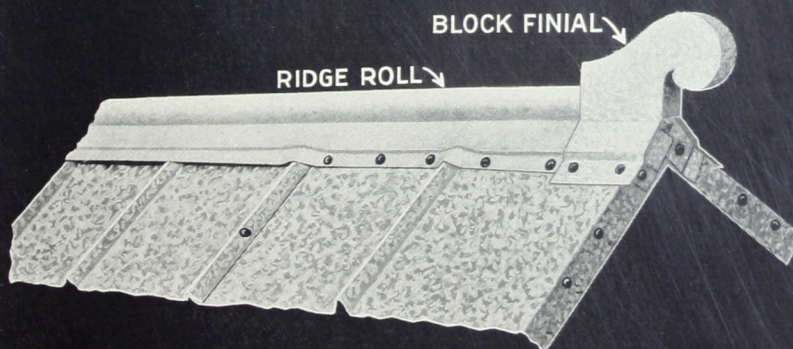


Fig. 3
Block Finial applied with V-Crimp Roofing

How to Lay 5 V-Crimp Sheets

The application of 5 V-crimp sheets is very similar to that of 3 V-crimp. While the former has two V-crumps on each side edge the latter has only one on each edge. The 5 V-crimp style compares very favorable with the Pressed Standing Seam roofing for a water-tight job. Application starts at the lower, outer corner, farthest removed from the source of prevailing storms, as described before. The starting sheet, shown in Fig. 1, page 55, as sheet No. 1, is prepared as follows:

Flatten only the outer V-crimp (No. 1) and mark the $1\frac{1}{4}$ -inch line for the gable end drip edge as was explained with 3 V-crimp roofing in the preceding section. Mark the $1\frac{1}{2}$ -inch eave drip edge.

Snip the lower outer corner of only "V" No. 1 to make the fold for the gable drip edge. Make cuts at the bottom of the sheet as shown in Fig. 1, page 52.

Snip the top of the sheet for the end lock flanges. Bend the edges with flanging tongs or against a straight piece of wood as in the case of 3 V-crimp.

Nail the gable end drip edge first. This leaves the second V-crimp as the finish along the gable end.

Bend the tabs of V-crimp No. 2 over the eave drip edge, then fold over the tab from "V" No. 1 and nail on the eave edge.

Bend the tabs of V-crimp No. 3, then the main eave drip edges, and nail firmly. Leave the square tab at "V" Nos. 4 and 5 free at this time.

It is not necessary to nail through V-crimp No. 2 as the nails in the gable drip edge are sufficient to hold the sheet. Nail the end lock seam as described in the preceding section.

Sheet No. 2, extending toward the ridge, is laid next. This second sheet in 5 V-crimp roofing is handled the same as the second sheet in the 3 V-crimp style, except that the double "V's" at each side of the sheet projects to make the end lap, and the end lock flange is shorter by the width of one more "V" on each side edge. Sheet No. 3 is laid in the same manner as the second sheet.

Sheet No. 4 starts the second width from eave to ridge. Form the $1\frac{1}{2}$ -inch eave drip edge. Snip the first and second "V's" at both tops and bottoms. Snip the third "V" in three places. Snip the fourth and fifth "V's" to make one square tab.

After inserting a wood strip under "V" No. 4 of

sheet No. 1, fit "V's" No. 1 and 2 of sheet No. 4 over "V's" Nos. 4 and 5 of sheet No. 1 respectively. Then nail the end lock flange. Figure 1, page 55 shows the side lap, location of the wood strip under the V-joint and the slant of the nails.

The overlapping side edge of the first "V" on sheet No. 4 is nailed on the slant through the under sheet and wood strip.

The square tabs of sheet No. 1 are lifted out so that all four tabs of "V's" No. 1 and 2 are folded down on the eave drip edge. Then the square tab is nailed in place as before. In this width as well as all following widths the triangular sticks are placed only under V-crimp No. 4. All other operations are similar to those previously described.

How to Finish the Ridge

The steel sheets from one side of the roof should come up even with ridge. The sheets from the other side should project about 1 inch above the ridge. Snip along each side of the projecting V-crimp back to the ridge line. Flatten down these "V" ends and drive one nail in each. Then flatten down the over-lap and nail frequently.

When both slopes of the roof have been covered with the V-crimp roofing apply 2-inch plain ridge roll having a 10-inch girth with nailing flanges as shown in Fig. 2, page 55. These nailing flanges can be stretched over each V-crimp by means of nails driven on each side of the crimp. The rest of the nailing flange should have the nails spaced not more than 6 inches apart. Use 1-inch galvanized barbed nails. Fig. 3, page 55, shows a block finial applied on the gable end of this ridge.

Proper care given the gable-end and eave drip edges by following the foregoing directions, will result in a roof covering that will prevent the most severe winds from lifting the edges and driving the rain back on to the wood. This will keep the wood deck from rotting.

How to Roof Hips and Valleys

With V-crimp roofing, use lengths of galvanized formed valley, preferably of 20-inch girth, as shown in Fig. 1, page 57, in roofing the valleys. This formed valley is placed on the wood deck so that the lower end, when cut as shown in Fig. 2, page 57, has $1\frac{1}{2}$ -inch eave drip edge after the nailing flange and valley lock edge have been cut along the eave line. Do not drive any nails in the body of the valley, but space them 12 inches apart along



Fig. 1
Galvanized Formed Valley
(20-inch girth)



Fig. 2
Formed Valley applied

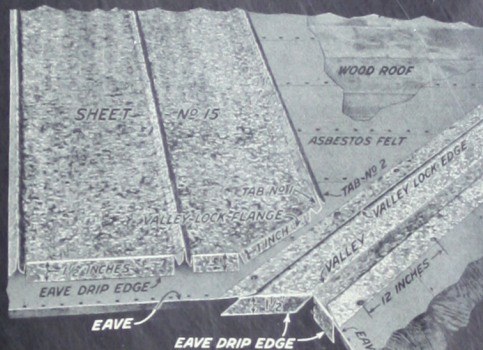


Fig. 3
First Sheet that touches
the Valley with cuts
made before application

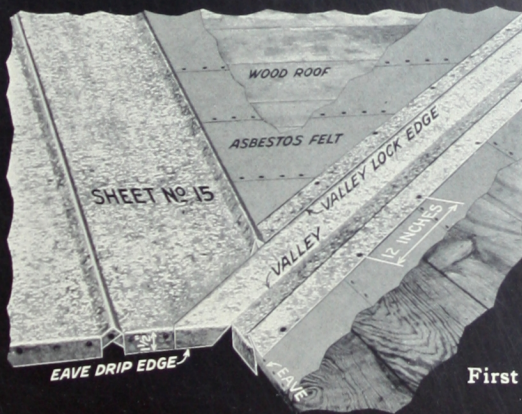


Fig. 4
First Valley Sheet
applied

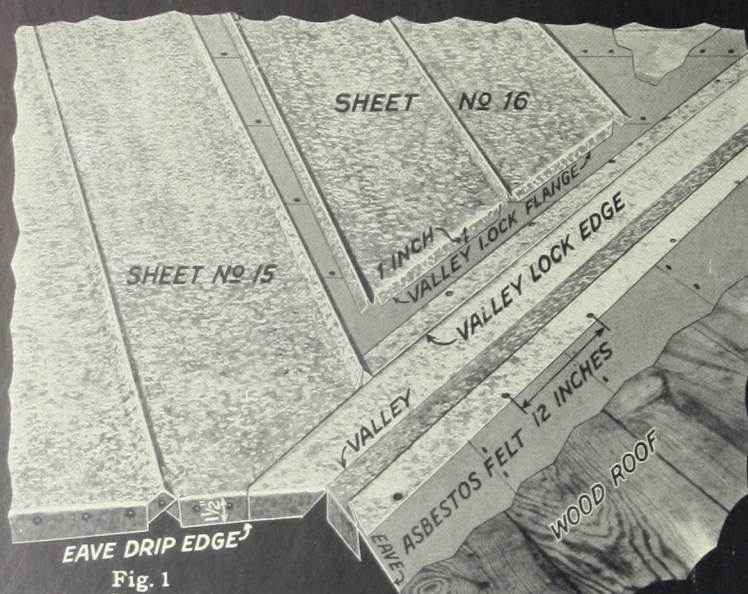


Fig. 1
Second Valley Sheet with cuts made
before application

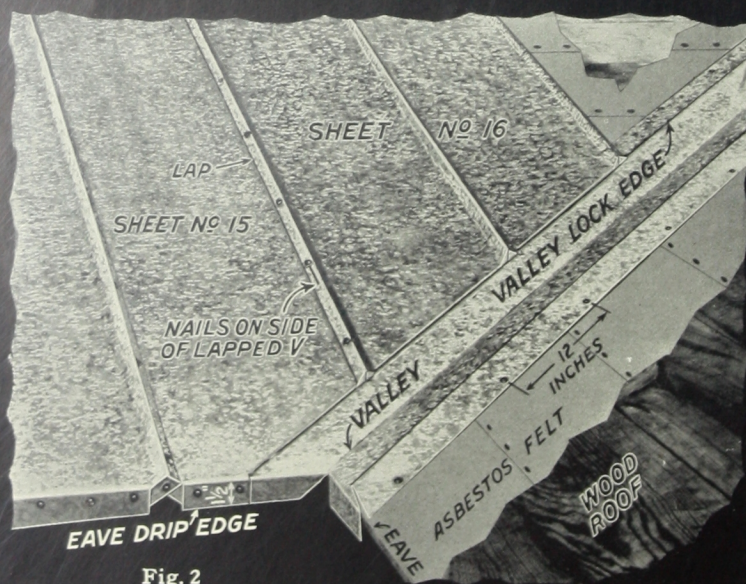


Fig. 2
Second Valley Sheet applied

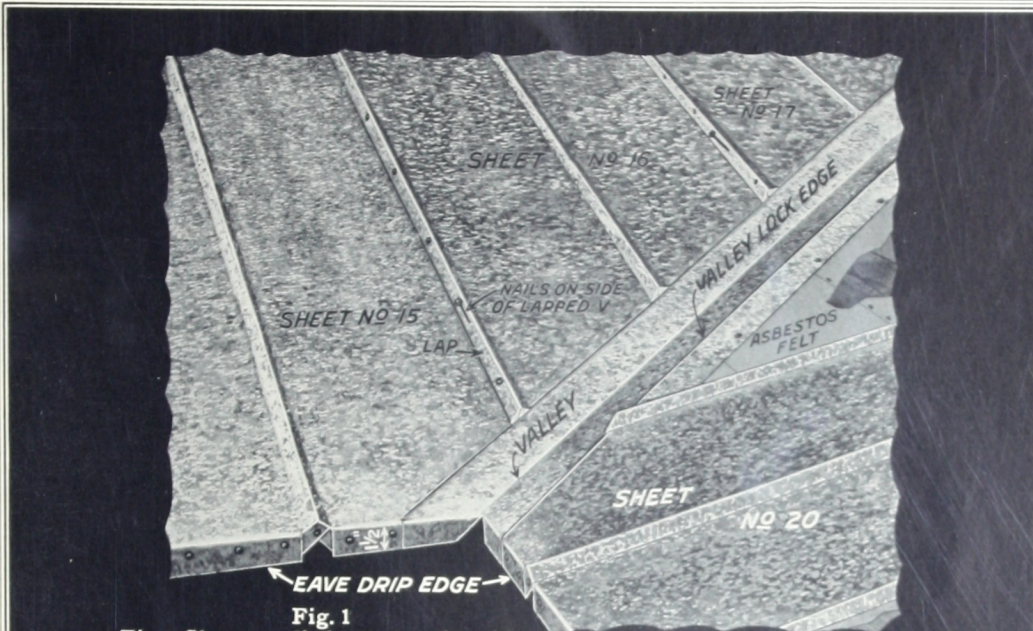


Fig. 1
First Sheet applied on opposite side
of Valley

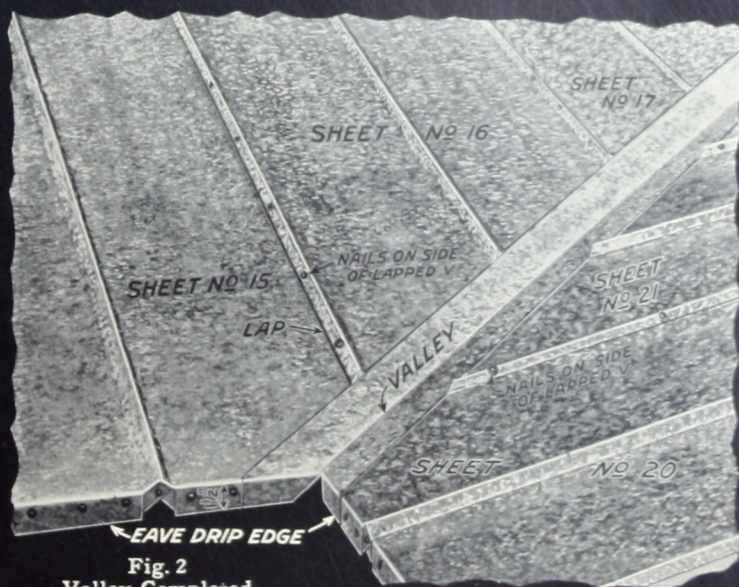


Fig. 2
Valley Completed

each nailing flange. It is recommended that the lock edges of the formed valley be given a rough coat of paint before the valley is put on the roof.

The first sheet of 3 V-crimp roofing to actually fit into the valley is sheet No. 15, because sheets Nos. 1 to 14 have already been applied on the left-hand roof. Sheet No. 15 has a 1½-inch eave drip edge, and the 1-inch valley lock flange is cut as shown in Fig. 3, page 57. This angle for the valley lock edge is readily obtained from the valley itself by first cutting the eave drip edge for the left part of the sheet, placing the sheet in its position and then marking a line with pencil on the right-hand part of sheet No. 15 immediately over the valley lock edge. The eave drip edge is bent down to fit against the wood eaves, while the valley lock edge is bent down and then backwards to form a hook edge so that when sheet No. 15 is placed in its final position, this hook edge is locked into position as shown in Fig. 4, page 57.

After the sheet is fitted snugly into its final position so that the left V-crimp overlaps sheet No. 14, and the wood strip is inserted, sheet No. 15 is then fastened into place by driving nails 8 inches apart, on the slant through the lap into sheet No. 14. The tabs on the "V" at the eave are folded under first, then the tabs of the right V-crimp are folded under the valley lock edge, putting the left tab (No. 1) down first and then the right tab (No. 2) second. The eave drip edge is then nailed and the valley lock hammered down flat.

The left V-crimp of sheet No. 16 is fitted over sheet No. 15 so that it can be marked along the valley lock edge for the full width of the sheet. Both valley lock flanges are cut 1 inch wide and turned down as shown in Fig. 1, page 58, which also shows the tabs of the V-crumps. This sheet (No. 16) is then lapped over the edge of sheet No. 15, and the wood strip inserted.

This sheet is next fitted snugly into the valley by having the valley lock flanges turned backwards, and the tabs folded under as shown in Fig. 2, page 58. Nails are driven on the slant along the side lap V-crimp. The valley lock is then hammered down flat making a finished job on this side of the valley.

It should be noticed that no nails are exposed

in the valley. The lower end of the sheet has no holes in it. The tabs are bent over to shed the water in the natural way over the fold. Sheet No. 17 is applied the same way as sheet No. 16, keeping the upper ends of all sheets in that course in the same horizontal line. On this particular roof it required sheets No. 18 and 19 to complete the far side of the valley.

The near side of the valley is best covered by starting at the bottom and working up towards the top so that the upper sheets may lap over the lower sheets and thus provide the natural water shed. For the sake of appearance, which is most noticeable in a valley, the V-joints should be nicely opposite each other.

The lower end of sheet No. 20 should have the same length of eave drip edge as sheet No. 15, and the same position of V-crumps as shown in Fig. 1, page 59. The near edge of sheet No. 20 has a wood strip under it but does not fit over any other sheet as none have yet been applied to this part of the roof. This sheet is nailed only along the eave drip edge, and the end lock flange.

Sheet No. 21, as shown in Fig. 2, page 59, corresponds with sheet No. 16 and is fitted in the same way. When the near V-crimp of sheet No. 21 is placed over sheet No. 20, the lap is on the low side of the "V." This results in water-tight construction. The tabs along the valley lock edge are folded so that the higher tab laps over the top of the lower tab. Sheets Nos. 22, 23 and 24 follow sheet No. 21 in the same manner. Sheet No. 25 is the first full sheet away from the valley and it laps over the near "V" of sheet No. 20.

The hips are much easier to cover than the valleys. All that is necessary is to cut the roofing sheets on the slope of the hip so that the sheets from both sides just meet on the hip line. Then cover the hip joint with ridge roll, nailing this roll through the nailing flange.

Flashing for V-Crimp Roofing

For information concerning the proper flashing to use with V-crimp roofing, please see chapter VI, entitled, "Galvanized Steel Flashing."



Pressed Standing Seam Roofing

How to Measure for Pressed Standing Seam Roofing

WITH Pressed Standing Seam roofing it is necessary to order side and end cleats made of steel with which to fasten the sheets to the roof deck. All body sheets are fastened to the roof with these cleats. One-inch galvanized barbed nails are used. The only nails that are driven through the sheets themselves come on the eave and gable drip edges. The horizontal or cross joints have end lock seams cleated.

For roofs with a steep pitch the cross joint may be nailed under the end lock flange; for flatter roofs the cross joint should be fastened with cleats that are entirely concealed. The side joint cleats are not concealed.

This type of roofing not only provides a watertight job but may be taken off and re-applied with the loss of only the cleats and the drip edges. In applying it, one width at a time is completed from eave to ridge as in the case of V-crimp.

Suppose the shed roof shown in Fig. 1, page 22, is to be covered with Pressed Standing Seam roofing. This roof measures 31 ft. 3 ins. along the high eave and 9 ft. 5 ins. on the slope. Since each sheet of Pressed Standing Seam roofing covers 2 feet in width, this roof, after the eave length has been increased to the next higher even foot, namely 32 feet, requires sixteen sheets each 10 feet long. The cleats, about 1 inch wide by $4\frac{1}{2}$ inches long, are furnished with the roofing at an extra cost. These cleats should be of as heavy a gauge as the roofing. About one pound of ready bent side cleats and about $\frac{1}{5}$ pound of ready bent end cleats are required for each 100 sq. ft. of roofing. Multiplying the length, 32 feet, by the slope, 10 feet, gives 320 sq. ft. or $3\frac{1}{5}$ squares of roofing. At the rate of one pound of side cleats per square, this roof would require $3\frac{1}{5}$ pounds of ready bent side cleats.

It so happens on this particular roof that the sheet itself is nailed at both top and bottom ends and therefore does not need end cleats. However,

if a larger roof were under consideration and end cleats were necessary, this area of roofing sheets would require $\frac{1}{5}$ times $3\frac{1}{5}$ (No. of squares) or about $\frac{2}{3}$ pound of end cleats. This calculation is rather exact for such a small order, so it would be much better to order even quantities of the cleats as they are easily bent for interchangeable use. Hence, this shed roof would require the following bill of material:

16 sheets galvanized Pressed Standing Seam roofing 10 feet long, 28 gauge (or heavier).
3 pounds ready bent side cleats.

How to Lay Pressed Standing Seam Roofing

To apply Pressed Standing Seam roofing you will want to rent, borrow or buy "Squeezing Tongs" as well as "Tinner's Snips" and "Flanging Tongs." These are illustrated on page 36. If squeezing tongs and flanging tongs are not easily obtainable, the flanges and drip edges can be made by bending down the edges of the sheets over a straight piece of board and the standing seams can be closed by placing a board along one side of them and pounding them flat with a hammer.

The starting point with Pressed Standing Seam roofing depends upon the direction of prevailing storms, as explained in Chapter 1.

Fig. 1, page 62, shows the first sheet, with the necessary cuts, ready for application. This starting sheet is prepared as follows:

Flatten the edge seam and mark a line $1\frac{1}{4}$ inches in from the edge for the gable end drip edge.

Mark a line $1\frac{1}{2}$ inches up from the lower end for the eave drip edge.

Snip the lower outer corner and then cut the square tab at the other standing seam, all as shown in Fig. 1, page 62. Snip the top end of the sheet to form the $\frac{3}{4}$ -inch end lock flange also illustrated in Fig. 3, page 62.

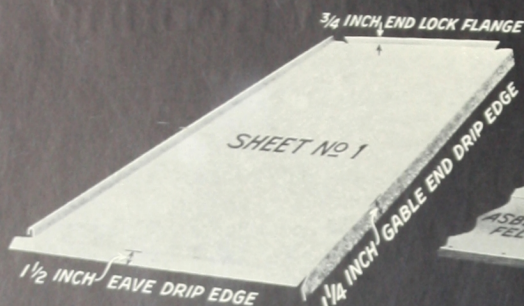


Fig. 1
First Sheet of Pressed Standing
Seam Roofing with cuts made
before application

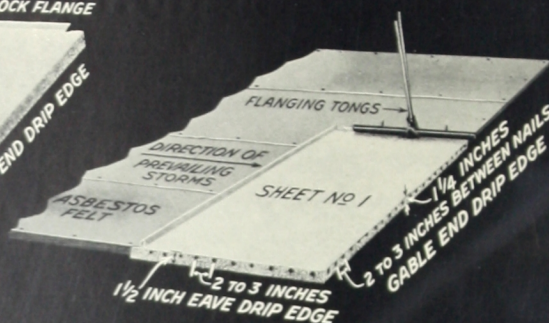


Fig. 2
First Sheet applied

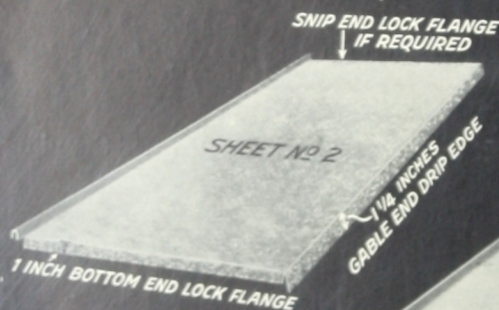


Fig. 4
Second Sheet with cuts
made before application

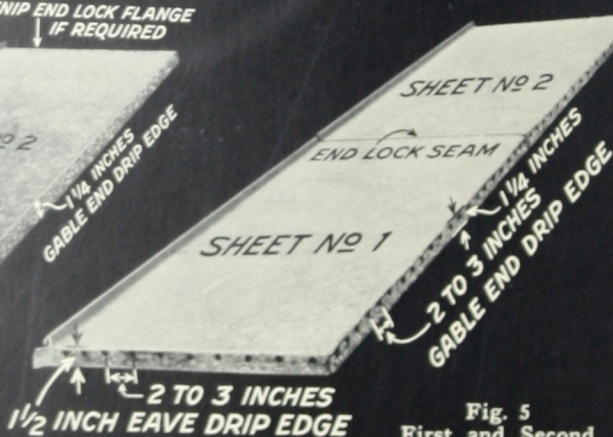


Fig. 5
First and Second
Sheets applied



Fig. 3
End Cleats applied

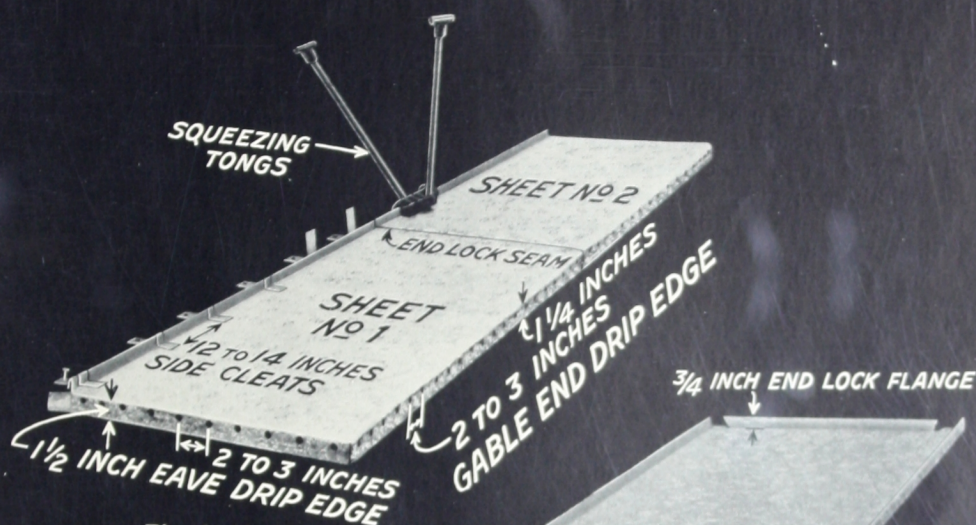


Fig. 1
First and Second Sheets
of Pressed Standing Seam
Roofing with Cleats
applied



Fig. 2
First Sheet in second
row (Sheet No. 4) show-
ing cuts

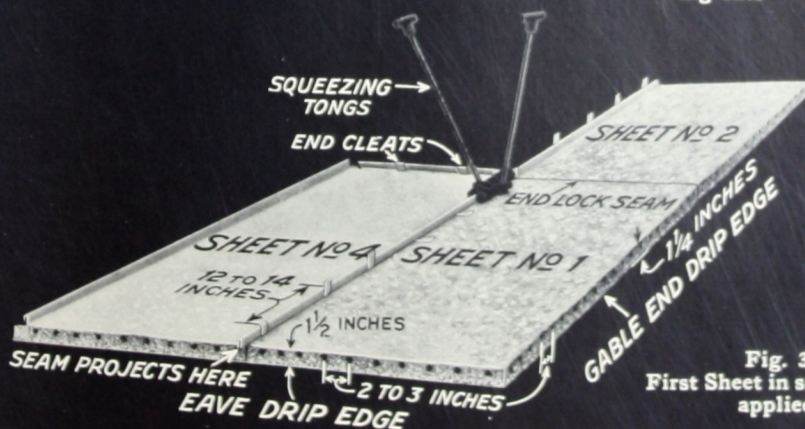


Fig. 3
First Sheet in second row
applied

Measure in from the gable drip edge a distance equal to the covering width of the flanged sheet at both the eave and the ridge. Mark these points on the roof and draw a straight line between them. This line is the guide for the left edge of the first width of sheets when applied. It is recommended that, as the work progressed, the covering width of the sheets already laid be checked at both eave and ridge so as to make certain that each succeeding width or row is parallel with the first. If this checking reveals a variation in the covering width at the eave and at the ridge, this variation can be adjusted in either one of two ways; first, by keeping the body of the sheets tight at the base of the flanges; second, by allowing a space between the sheets at the base of the flanges. In any event the top of the pressed standing seam must always be squeezed up tight.

With the flanging tongs bend down the gable drip edge, fold the corner under and then bend down the eave drip edge.

The starter sheet is applied by nailing the gable drip edge first, spacing the nails from 2 inches to 3 inches apart, as shown in Fig. 2, page 62. Then nail the eave drip edge across the width of sheet.

Bend down the end lock flange at the top of the sheet almost flat, as shown in Fig. 3, page 62. Hook the small end of an end cleat under the end lock seam flange and then drive two galvanized barbed roofing nails 1 inch long through the single thickness of cleat close up to the fold of the flange. Use two cleats to each cross joint in each sheet.

Everything is now ready for sheet No. 2. Figure 4, page 62, shows the second sheet with the necessary cuts, made as follows:

Flatten the edge seam and mark a line $1\frac{1}{4}$ inches in from this side for the gable drip edge. Mark a line 1 inch from the bottom end of sheet No. 2 to form the flange that locks into the top of sheet No. 1. Mark a line $\frac{3}{4}$ inch from the top end of sheet No. 2 for the upper end lock flange that joins with sheet No. 3. Snip the bottom edge to make the end lock flange. Make the diagonal cuts for the top end lock flange. With the flanging tongs bend down the lower or bottom end lock flange and bend up the upper end lock flange.

Fit the lower end of sheet No. 2 over the upper end of sheet No. 1, as shown in Fig. 5, page 62, so that the end lock flanges hook together and the pressed seam on the free edge fits over the seam of sheet No. 1.

While holding the end seam tight, hook and nail two end cleats under the lock seam at the top of sheet No. 2 to prevent it from sliding down the roof.

With a hammer or wood mallet, flatten the end lock seam so it makes a smooth joint. Now nail the gable-end drip edge, spacing the nails from 2 inches to 3 inches apart as before. Do not drive any exposed nails in the cross seam or in the body of the sheet. If the roof is large enough to require three or more sheets from the eave to ridge, all the following sheets in this width are cut and applied in the same manner as sheet No. 2 with a top end lock flange.

Assuming that it takes three sheets to reach from the eave to the ridge, the next step is to fasten the side cleats and proceed with the second width of sheets.

Nail the short end of the cleat close to the standing seam of sheet No. 1, using two galvanized barbed roofing nails 1 inch long to each cleat, and spacing the cleats about 12 to 14 inches apart along the seam as shown in Fig. 1, page 63. Bend the long upstanding end of the cleat over the standing seam of sheets No. 1, 2 and 3 to fit closely on both sides of the seams.

Mark a line $1\frac{1}{2}$ inches along the end of sheet No. 4 to form the eave drip edge, as shown in Fig. 2, page 63. Snip the drip edge close to the seam that fits over sheet No. 1. Snip a square tab at the other or free seam. Mark and make the diagonal cuts for the $\frac{3}{4}$ -inch lock flange at the top of the sheet.

Fit the open standing seam of sheet No. 4 over the top of the side seam of sheet No. 1 and also over the cleats that have been placed on this seam, keeping the eave drip edge on the same line as that of sheet No. 1. The standing seam only projects $1\frac{1}{2}$ inches beyond the eave line, as shown in Fig. 3, page 63. Hook two cleats on the lock flange at the upper end of sheet No. 4 and nail the cleats to keep the sheet from slipping down.

Bend the exposed end of the side cleats up and over the standing seam of sheet No. 4 so that they fit closely on both sides of the seam. Use the squeezing tong on this cleated standing seam to squeeze both the seam and the cleats tight together. If no tongs are available, place a 2-inch plank against one side of the seam and close the seam by hammering it against the plank. This makes the finished seam. The projecting end of the standing seam is now bent back on itself along the finished

seam, as shown in Fig. 2, page 66. The eave drip edge is nailed as before.

Sheet No. 5 is marked and snipped with square end cuts for the 1-inch lock flange at its lower end and with $\frac{3}{4}$ -inch diagonal cuts for the lock flange at its upper end, as shown in Fig. 1, page 66. This sheet fits over sheet No. 2 and is held by the cleats in the same manner as described for sheet No. 4, and as shown in Fig. 3, page 63.

Sheet No. 6 is handled similar to sheet No. 5 and the balance of the job progresses in the same manner except that the last width of sheets is trimmed along the gable end drip edge the same as were sheets Nos. 1, 2 and 3.

How to Finish the Ridge

The steel roofing on the near side of the ridge first covered should extend up even with the ridge line, provided the sheets are long enough and the lap at the lower end of the top course, is sufficient. Bend over the pressed standing seam for a distance of 6 to 8 inches from the ridge as shown in Fig. 3, page 66. It should be noted that the seam is flattened down on the side opposite from the origin of prevailing storms.

The sheets on the other side of the ridge should project about 1 inch above the ridge, again provided that the sheets and laps are long enough. Snip off the pressed standing seam flush with the ridge line. Flatten down the overlapping edge and fasten it with 3 or 4 nails. Then flatten down 6 or 8 inches of the pressed standing seam as was done on the near side of the ridge first covered, making sure that the fold is turned away from the origin of prevailing storms.

When all seams have been flattened down on both sides of the ridge, apply 2-inch plain ridge roll having a 10-inch girth with nailing flanges as shown in Fig. 4, page 66. These nailing flanges can be stretched over each folded seam by means of nails driven close to and on each side of the seam. The rest of the flange should have the nails spaced not more than 6 inches apart, using 1-inch galvanized barbed nails and lead washers. A finial applied to the gable ends of the ridge gives a finished appearance. If no finials are used, the ends of the ridge roll should be cut and folded as shown in Fig. 4, page 45.

How to Roof Hips and Valleys

With Pressed Standing Seam roofing, use lengths of galvanized formed valley, preferably of 20-inch

girth, as shown in Fig. 1, page 57, in roofing the valleys. This formed valley is placed on the wood deck so that the lower end, when cut as shown in Fig. 2, page 57, has a $1\frac{1}{2}$ -inch eave drip edge after the nailing flange and valley lock edge have been cut along the eave line. Do not drive any nails in the body of the valley, but space them 12 inches apart along each nailing flange. It is recommended that the lock edges of the formed valley be given a rough coat of paint before the valley is put on the roof. The first sheet of Pressed Standing Seam roofing to actually fit into the valley is sheet No. 15, because on this particular roof sheets Nos. 1 to 14 inclusive have already been applied on the left-hand slope. Sheet No. 15 has a $1\frac{1}{2}$ -inch eave drip edge, and the 1-inch valley lock flange is cut as shown in Fig. 1, page 67. This angle for the valley lock edge is readily obtained from the valley itself by first cutting the eave drip at the left seam and bending this corner down so as to get the right amount of projection for the eave, then placing the sheet in its correct position with the left seam of sheet No. 15 fitting over the right seam of sheet No. 14, and marking a line with pencil on the right hand part of sheet No. 15 immediately over the valley lock edge. The 1-inch valley lock flange is then marked below this pencil line and cut with the snips as shown. The right standing seam is cut flush with the line of the valley lock edge.

The eave drip edge is bent down to fit against the wood eaves, while the valley lock edge is bent down and then backwards to form a hook edge so that when sheet No. 15 is placed in its final position, this hook edge is locked into position as shown in Fig. 2, page 67. After the sheet is fitted snugly into its final position and the left standing seam of sheet No. 15 is squeezed on top of sheet No. 14, the eave drip edge is nailed into position. The side nailing cleats are spaced and nailed about 15 inches apart along the right standing seam and then bent over.

The left seam of sheet No. 16 is now fitted over the right standing seam of sheet No. 15, keeping the top ends of the sheets in line. Mark a line on sheet No. 16 immediately over the valley lock edge for the full width of the sheet. The valley lock flange is cut 1 inch below this pencil line and bent down and backwards, leaving the end of the left standing seam projecting 1 inch on the low side of the sheet and the right seam on the high side cut flush, as shown in Fig. 2, page 67. This sheet (No.

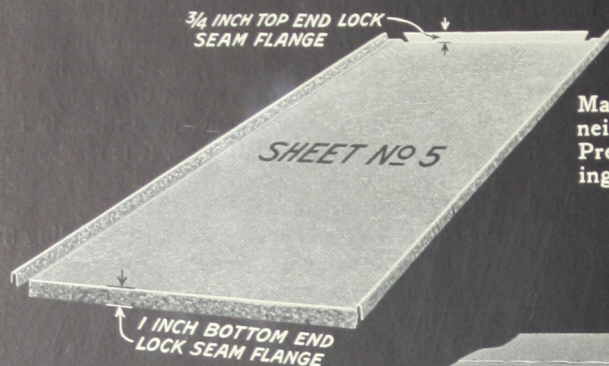


Fig. 1
Main Body Sheet (touching
neither eave nor gable end) of
Pressed Standing Seam Roof-
ing showing cuts

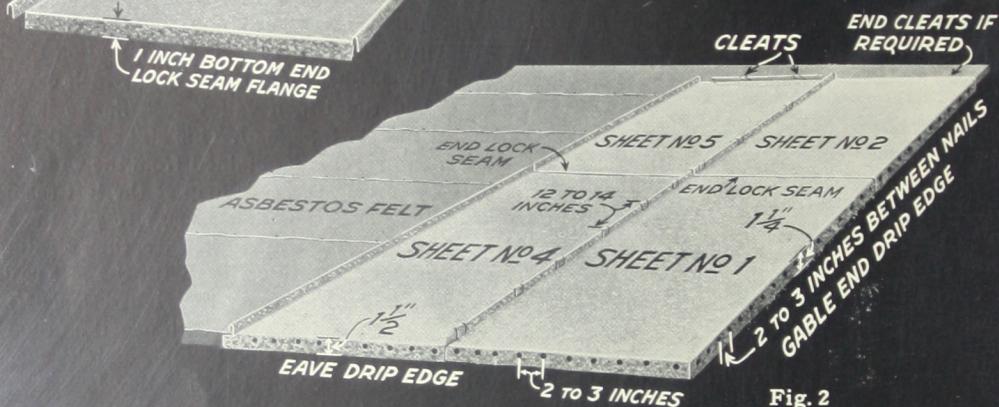


Fig. 2
Main Body Sheet
applied

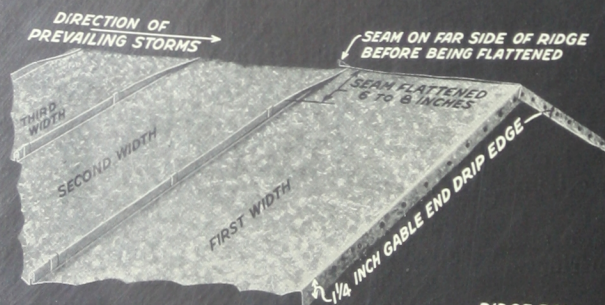


Fig. 3
Pressed Standing Seams
flattened at Ridge

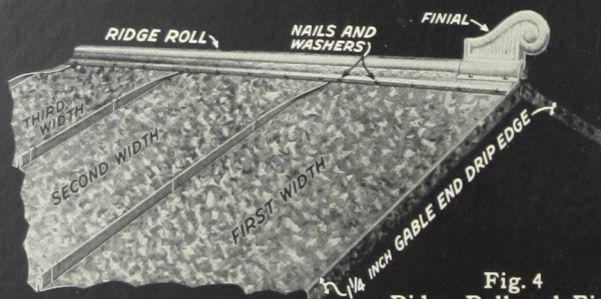


Fig. 4
Ridge Roll and Finial
applied

Fig. 1
First Valley Sheet (sheet No. 15) of Pressed Standing Seam Roofing showing cuts

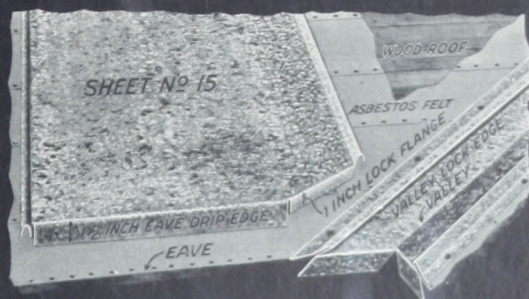


Fig. 2
First Valley Sheet applied. Second Sheet with cuts ready for application

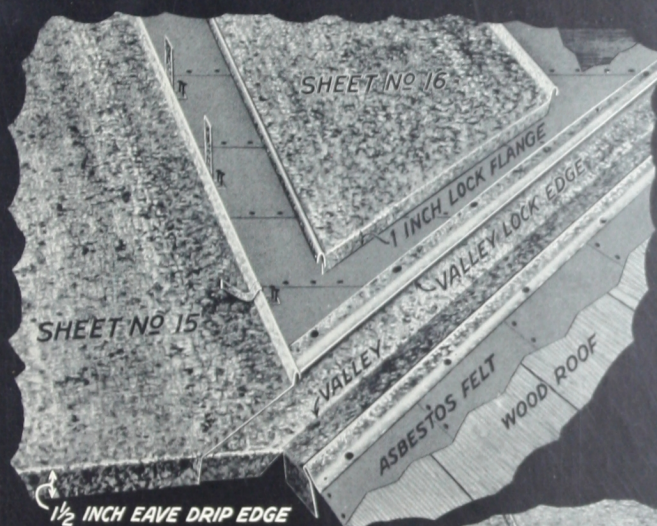
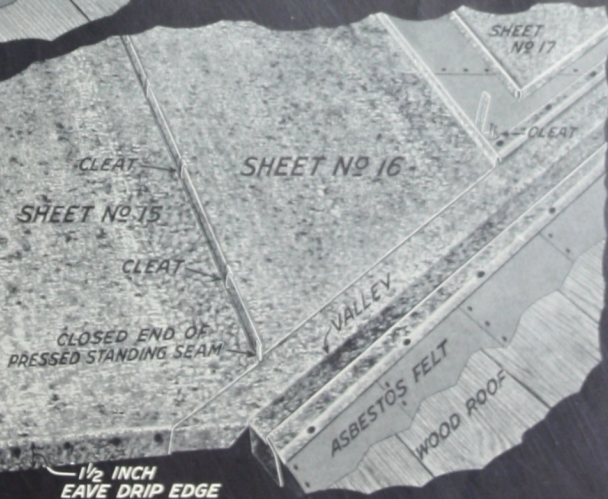


Fig. 3
Second Sheet applied



16) is lapped over the edge of sheet No. 15 and the valley lock flange is folded backwards under the valley lock edge, as shown in Fig. 3, page 67.

Two nails are driven either in the end cleats or under the cross lock seam flange at the top end of the sheet to prevent it from sliding down. The side cleats are folded over the top of the standing seam and then the whole seam and cleats are squeezed together with the cap squeezer. After the valley lock is hammered down flat, the projecting end of the standing seam is folded back on itself on the low side of the valley. This completes the job on one side of the valley. It should be noticed that no nails are exposed in the valley and the lower end of the sheet has no holes in it, as can be seen in the illustration.

Sheet No. 17, which is the next sheet up the valley, is cut and applied the same way as was sheet No. 16, keeping the upper end of all sheets in that course in the same horizontal line. On this particular roof it required sheets Nos. 18 and 19 to complete the far side of the valley.

The near side of the valley is best covered by starting at the bottom and working upwards toward the top so that the upper sheet will lap over the lower sheets and thus provide the natural water shed. For the sake of appearance, which is most noticeable in a valley, the joints should be directly opposite each other.

The lower end of sheet No. 20 should have the

same length of eave drip edge as sheet No. 15. The joints should be exactly opposite each other. The near edge of sheet No. 20 for the moment does not fit over any other sheet as none has yet been applied to this part of the roof. This sheet is nailed only at the upper cross lock flange and the eave drip edge.

Sheet No. 21 corresponds with sheet No. 16 and is fitted in the same way. When the near side seam of sheet No. 21 is placed over sheet No. 20, the lap is on the low side. This results in water-tight construction. Sheets Nos. 22, 23 and 24 follow sheet No. 21 in the same manner. Sheet No. 25 is the first full sheet away from the valley and it laps over the near seam of sheet No. 20.

The hips are much easier to cover than the valleys. Simply allow the roofing sheets on each side of the hip joint to overlap the joint about 1 inch. The pressed standing seams should be folded over toward the juncture of hip and eave in a manner similar to the fold at the ridge as shown in Fig. 3, page 66. Then cover the hip joint with ridge roll, nailing this roll through the nailing flange.

Flashing for Pressed Standing Seam Roofing

For information concerning the proper flashing to use with Pressed Standing Seam roofing, please see Chapter VI, entitled, "Galvanized Steel Flashing."



Self-Capping Roll Roofing

How to Measure for Self-Capping Roll Roofing



ROLL roofing, as shown in Fig. 1, page 70, consists usually of five sheets of steel, each sheet 10 feet long, having their ends locked together at the factory by double cross seam locks so as to form one continuous sheet 50 feet long. The customary width is $26\frac{1}{2}$ inches and each roll has a covering area of 100 sq. ft. when laid. To facilitate handling, the long sheet is put up in the form of a roll about 8 inches in diameter. The outside end of the rolled sheet is folded over a wood strip to protect it from damage in shipment.

The method of finishing the ridge should be determined in advance of ordering the material since the method adopted affects the length of each width or strip of roofing. The two methods of finishing the ridge are with either the standing seam or with ridge roll. The former requires a longer sheet to provide the seam at the ridge. The decision as to which type of ridge finish will be used, is easily made by referring to the section on page 74, entitled, "How To Finish the Ridge." Figure 2, page 73, shows the completed standing seam ridge finish, and Fig. 4 page 73, the roll type of ridge finish.

Suppose the shed roof shown in Fig. 1, page 22, is to be covered with Self-Capping Roll roofing. This roof measures 31 ft. 3 ins. along the high eave and 9 ft. 5 ins. on the slope. Since each roll covers a space 2 feet wide, this roof, after the eave length is increased to the next higher even foot, will require 16 widths of roofing material, each width being 9 ft. 9 ins. long to allow 2 inches overhang at both top and bottom ends. The total length of roofing required is sixteen (No. of widths) times $9\frac{3}{4}$ feet (length of each width) or 156 lineal feet. Since there are 50 feet in each roll, this would require three rolls and 6 feet extra. This extra 6 feet can be obtained by ordering either a single flat sheet of sufficient length or a fourth roll. The balance of this roll and the cleats

would come in handy for other small roofing jobs. Since the end locks of each sheet within the roll are made at the factory by cross lock seams, no end cleats are required as they are in the case of Pressed Standing Seam roofing sheets. Only side cleats are needed.

Hence, this shed roof would require the following bill of material:

Four rolls (one roll per square) galvanized Self-Capping Roll roofing, $26\frac{1}{2}$ inches wide, 50 feet long, 28 gauge (or heavier).

Four pounds (one pound per square) of ready formed side cleats.

How to Lay Self-Capping Roll Roofing

Start the work at the gable end farthest from the origin of the prevailing storms, as explained in Chapter 1, so that the caps on top of the seam have the advantage of the lee side of the storm and rain. If the slope of the roof is too steep to work upon with safety, then the roofing steel should be cut on the ground and each strip carried to the roof. If the roof can be worked upon safely, the full roll is usually carried to the comb or ridge after which the wire ties are cut. The free end of the roll is placed at the ridge with 1 inch allowed for the upstanding ridge flange, as shown in Fig. 2, page 70. The roll is allowed to unroll down the roof to the eave where it is cut off after allowing $1\frac{1}{2}$ inches for the eave drip edge.

It is most important that this width or strip and all other strips on the roof be so laid that rain water will run over the cross locked seam in the natural way instead of having the seam facing upwards so that it would hold water. The proper facing of this cross seam is shown in Fig. 1, page 70. If the cross joint of this first width, as well as others, does not face down the roof so as to properly shed the water, the strip must be either turned

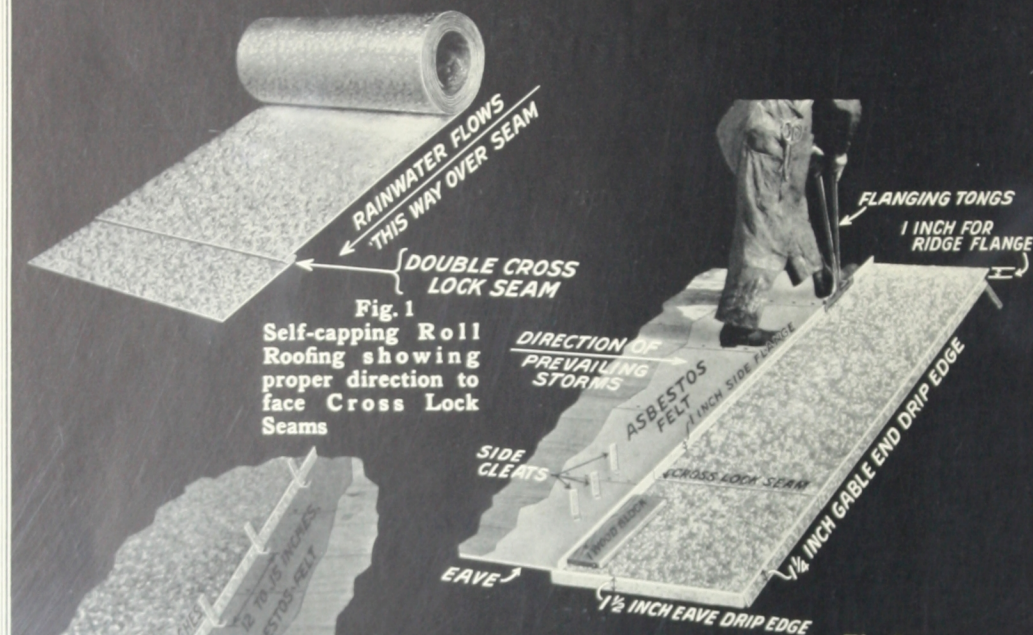


Fig. 4 Showing how Cleats are nailed close up to Flange

Fig. 2 First Width showing Cuts and Flanges

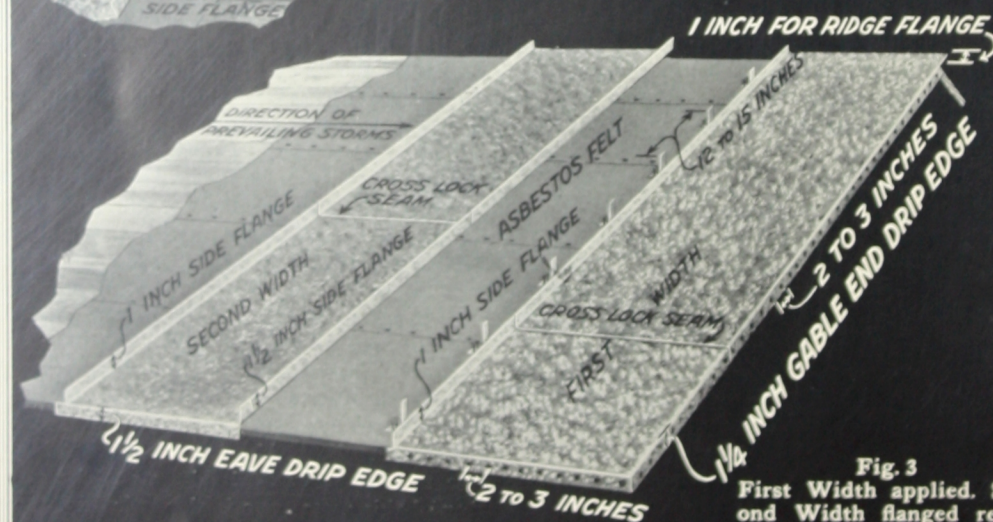


Fig. 3 First Width applied. Second Width flanged ready for application.

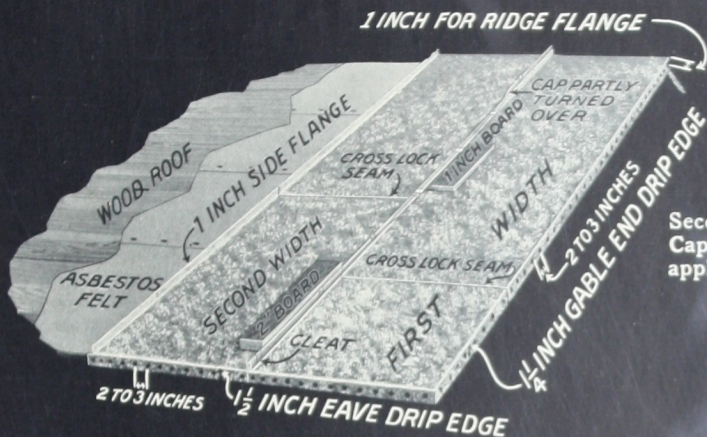


Fig. 1
Second Width of Self-Capping Roll Roofing applied

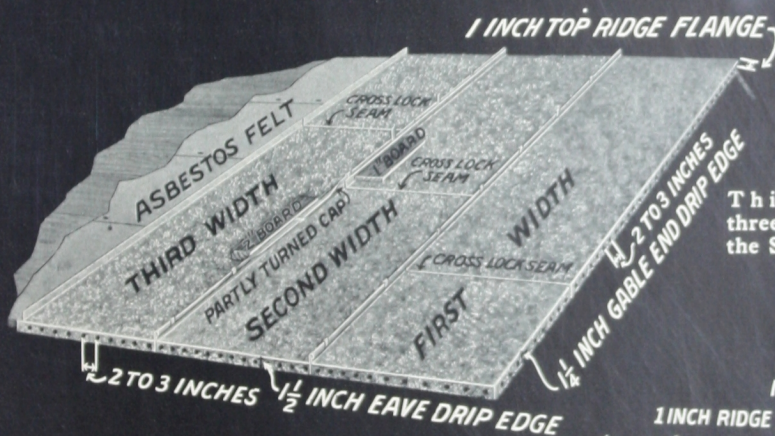
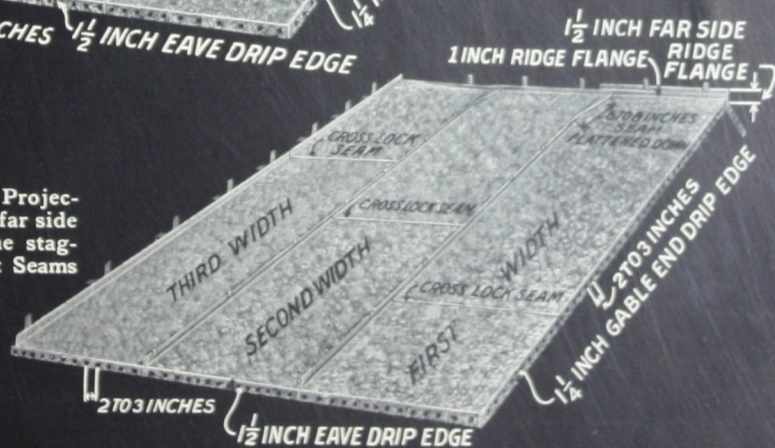


Fig. 2
Third Width showing three stages of Capping the Seam

Fig. 3
Showing Ridge Projection of Sheets on far side of Roof. Note the staggered Cross Lock Seams



bottom side up or the top end must be turned around so that it will become the bottom end with the same side up. With this done, the side flanges may be marked and formed.

Mark a line $1\frac{1}{4}$ inches from the right edge along which to form the gable end drip edge. Mark a line $1\frac{1}{2}$ inches from the bottom to form the eave drip edge. Make the three cuts at the corners as shown in Fig. 2, page 70. The gable end drip edge is bent down first and nailed with 1-inch galvanized barbed roofing nails spaced 2 or 3 inches apart. The eave drip edge is next bent down, the end tab folded under the gable drip edge, and nailed. The left-hand flange, 1 inch high, is then formed as shown in Fig. 2, page 70, either by using flanging tongs or by marking a line 1 inch from the edge and bending this edge up against a straight board or plank. The 1-inch flange is continued to the end of the sheet projecting over the ridge.

Cleats, spaced 12 to 15 inches apart as shown in Fig. 3, page 70, are then nailed along the left edge of the first width. Use two galvanized barbed roofing nails, 1 inch long, in each cleat and drive them close up to the flange as shown in Fig. 4, page 70. The cleats should stand about $1\frac{1}{2}$ inches above the top of the 1-inch flange.

The second width is unrolled the same way as the first width and cut to the same length, allowing for eave and ridge overhang. Be sure the cross seams face down the roof to properly shed the water. If the roll is unrolled the same way every time, the cross locked seams will come in their regular order which, in most all cases, will be similar to the staggered position shown in Fig. 3, page 71.

The second width has a $1\frac{1}{2}$ -inch flange turned up on the right edge, as shown in Fig. 3, page 70. Here again $1\frac{1}{2}$ -inch flanging tongs can be used or the flange can be bent up against the straight edge of a 2-inch board. The left flange is turned up 1 inch and the eave is flanged down as with the first strip. When the second width is placed in position along side the first width as shown in Fig. 1, page 71, the $1\frac{1}{2}$ -inch flange comes along side of the 1-inch flange with the cleats between them. The top of the cleats are now bent towards the left over the top of the $1\frac{1}{2}$ -inch flange, as shown by the one cleat in the upper part of the seam in Fig. 1, page 71. The projecting $\frac{1}{2}$ inch together with the cleats,

is turned down over the top of the 1-inch flange and closed tight as shown in the lower part of the seam in Fig. 1, page 71. This turned-over cap should be continued along the seam to the top end. The nailed cleats now fasten both widths securely. The eave is nailed the same as with the first strip.

The third width or strip is cut and laid in the same manner as the second width, which again shows the staggered position of the cross seam. All succeeding widths repeat the same as the second and third widths. The upper ends of the finished standing seams shown in Fig. 2, page 71, are flattened down for a distance of 6 to 8 inches below the ridge and the 1-inch ridge flange is turned up as shown in Fig. 3, page 71. Nailing cleats are now fastened along the ridge on the far side, using two cleats to each width or strip as shown in Fig. 3, page 71.

The first width on the far side of the ridge is applied at the same gable end as was the first width on the near side of the ridge. All strips on the far side project $1\frac{1}{2}$ inches above the ridge instead of 1 inch as was the case with the strips on the near side. This is shown in Fig. 3, page 71. It should be noted that the 1-inch side flange is kept toward the direction of prevailing storms so that the $1\frac{1}{2}$ -inch flange caps over the 1-inch flange just as if the roofing continued over the ridge instead of being cut. The finished standing seams on the far side of the ridge are flattened in the same manner as those on the near side. The $1\frac{1}{2}$ -inch ridge flange is turned up as shown in Fig. 3, page 71.

Frequently, it is necessary to splice or connect the finishing end of one roll with the starting end of the next roll, so as to use all of the material without undue waste. This is easily done as both ends of all rolls are folded over once. These two ends could be used as they are by simply hooking one into the other, but this gives only a single-lapped joint. A much better joint can be obtained by making a second fold the same size as the first fold in each roll. The folds on one roll are turned up and on the other are turned down. The two ends are then brought together so that the right side of one end is even with and touching the left side of the other end. With the double folds of one end meshed into the double folds of the other end, the one sheet is pushed sideways until both sheets make one continuous sheet. Then the joint is hammered flat.

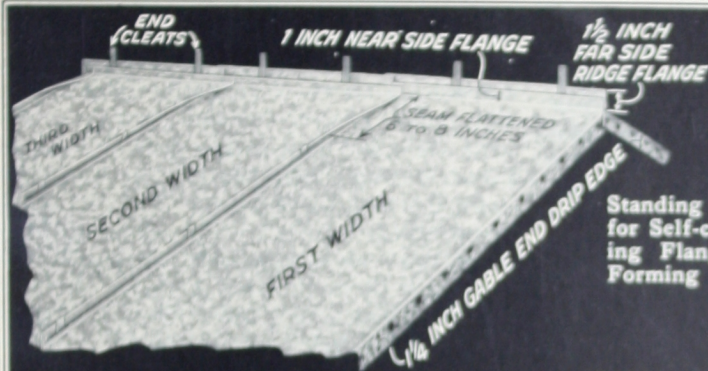


Fig. 1
Standing Seam style of Ridge Finish
for Self-capping Roll Roofing, showing
Flanges and Cleats for Final
Forming

Fig. 2
Standing Seam Ridge
Finish completed

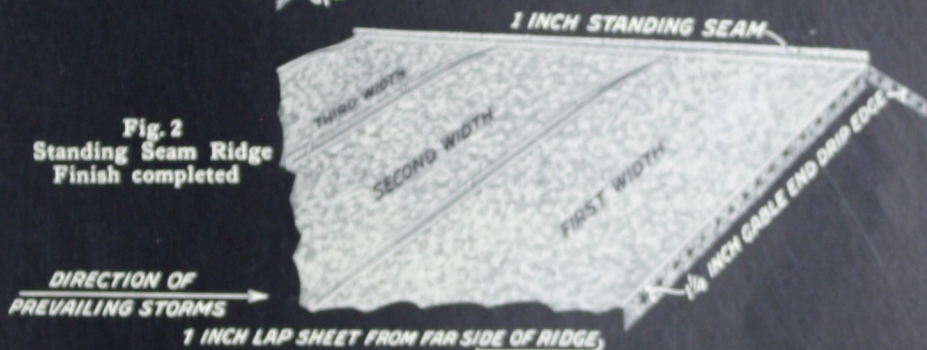


Fig. 3
Preparation for Ridge Roll
style of finish

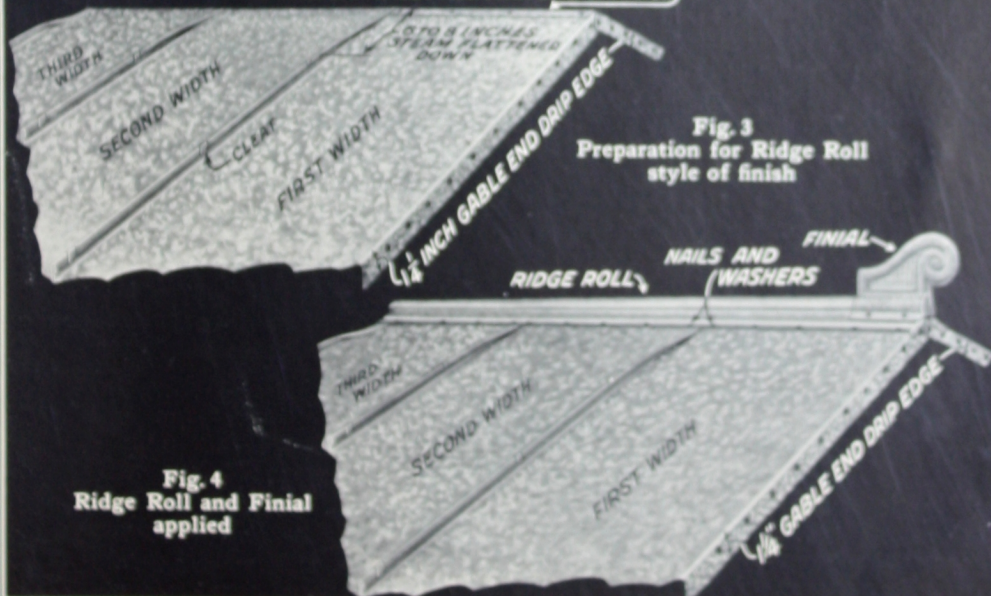


Fig. 4
Ridge Roll and Finial
applied

How to Finish the Ridge

The finish of the ridge in the treatment of Self-Capping Roll roofing, as noted on page 69, may be either with a standing seam finish or with ridge roll. The roofing as shown in Fig. 1, page 73, is all prepared for the forming of a standing seam finish.

The ridge cleats are first bent backwards over the top of the 1½-inch ridge flange. This flange, together with the cleats, is bent forward and down over the 1-inch flange to finish the standing ridge seam as shown in Fig. 2, page 73.

In those cases where a standing seam ridge is not desired, the roof may be finished with a ridge roll. In this case, the roofing sheets on the near side are cut off flush with the ridge line; the sheets from the far side should overlap the near side about 1 inch and be nailed occasionally as shown in Fig. 3, page 73. The ridge roll is applied with nails and lead washers as shown in Fig. 4, page 73, special attention being given to the two nails on either side of the flattened down seams. The ridge finials complete the job.

How to Roof Hips and Valleys

With Self-Capping Roll roofing, use lengths of galvanized formed valley, preferably of 20-inch girth, as shown in Fig. 1, page 57, in roofing the valleys. This formed valley is placed on the wood deck so that the lower end, when cut as shown in Fig. 2, page 57, has 1½ inches eave drip edge after the nailing flange and valley lock edge have been cut along the eave line. Do not drive any nails in the body of the valley, but space them 12 inches apart along each nailing flange. It is recommended that the lock edges of the formed valley be given a rough coat of paint before the valley is put on the roof.

The first sheet of Self-Capping Roll roofing to actually fit into the valley is sheet No. 15, because sheets Nos. 1 to 14 inclusive have already been applied on the left-hand slope. Sheet No. 15 has a 1½-inch eave drip edge and a 1-inch valley lock flange which are cut similar to that shown in Fig. 1, page 67. This angle for the valley lock edge is readily obtained from the valley itself by first cutting the eave drip edge at the left flange and bending this corner down so as to get the right amount of projection for the eave, then placing the sheet in its correct position with the left flange of sheet No. 15 fitting against the right flange of sheet No.

14, and marking a line with pencil on the right-hand part of sheet No. 15 immediately over the valley lock edge. The 1-inch valley lock flange is then marked below this pencil line and cut with the snips as shown. The right flange is cut flush with the line of the valley lock edge.

The eave drip edge is bent down to fit against the wood eaves, while the valley lock edge is bent down and then backwards to form a hook edge so that when sheet No. 15 is placed in its final position, this hook edge is locked into position similar to that shown in Fig. 2, page 67. After sheet No. 15 is fitted snugly into its final position the side cleats are bent over the top of its 1½-inch flange. This flange and the cleats are then bent over the 1-inch flange of sheet No. 14 to form the cap. The eave drip edge is then nailed into position. The side nailing cleats are spaced and nailed about 15 inches apart along the right flange.

The left 1-inch flange of sheet No. 16 is now fitted against the right flange and cleats of sheet No. 15. Mark a line on sheet No. 16 immediately over the valley lock edge for the full width of the sheet. The valley lock flange is cut 1 inch below this pencil line and bent down and backwards, leaving the end of the left flange projecting 1 inch on the low side of the sheet. The right flange on the high side is cut flush, similar to that shown in Fig. 2, page 67. The flange of this sheet (No. 16) is capped over the flange and cleats of sheet No. 15 and the valley lock flange is folded backwards under the valley lock edge.

After the valley lock is hammered down flat, the projecting end of the flange is folded back on itself on the low side of the valley. This completes the job on one side of the valley. It should be noticed that no nails are exposed in the valley and the lower end of the sheet has no holes in it.

Sheet No. 17, which is the next sheet up the valley, is cut and applied the same way as was sheet No. 16. On this particular roof is required sheets Nos. 18 and 19 to complete the far side of the valley.

The near side of the valley is best covered by starting at the bottom of the valley and working up towards the top of the valley so that each succeeding width of roofing laps over the width previously laid and thus provides the natural water shed. For the sake of appearance, which is most noticeable in a valley, the capped flanges should be directly opposite each other.

The lower end of sheet No. 20 should have the same length of eave drip edge as sheet No. 15, and the same position of flanges similar to that shown in Fig. 2, page 67, and Fig. 2, page 59. The near $1\frac{1}{2}$ -inch flange of sheet No. 20 for the moment does not fit over any other sheet as none has yet been applied to this part of the roof. Side cleats are nailed along this near flange and bent over it to hold the sheet in position. This sheet is nailed only at the eave drip edge. Side cleats are then nailed along the 1-inch flange on the other edge of the sheet No. 20.

Sheet No. 21 corresponds with sheet No. 16 and is fitted in the same way. When the near flange of sheet No. 21 is placed against sheet No. 20, the lap of the cap is on the low side. This results in water-tight construction. Sheets Nos. 22, 23 and 24 follow sheet No. 21 in the same manner. Sheet No. 25 is the first full sheet away from the valley and it butts against the near flange of sheet No. 20.

The hips are much easier to cover than the valleys. All that is necessary is to cut the roofing sheets on the slope of the hip so that the sheets from both sides just meet on the hip line. The hips may then be finished in either one of the two ways as outlined for the ridge finish, namely with the standing seam or with standard ridge roll. In both cases the roofing steel is cut on the same angle as the hip. If the ridge roll is used, the standing seams should be flattened down toward the juncture of hip and eave, and the nailing flange of the ridge roll should be securely nailed on each side of the standing seams. This will prevent snow or rain from blowing in under the ridge roll.

Double Standing Seam Roofing

The Roll roofing, as shown in Fig. 1, page 70, is

used for either the Self-Capping roofing or for Double Standing Seam roofing. The operations necessary to form the Self-Capping seams are few and comparatively easy since only one thickness of metal is bent.

To make a double standing seam, however, there is an additional operation which necessitates bending two thicknesses of metal within the short distance of $\frac{1}{2}$ inch. This cannot be done satisfactorily without the help of the tool known as a "Double Seamer."

Hence, if this type of roofing is desired—and it is the most satisfactory of all types for nearly level or flat slopes—it is necessary to have the following full set of tools:

- One pair $1\frac{1}{2}$ -inch flanging tongs
- One pair $1\frac{3}{4}$ -inch flanging tongs
- One pair 1 -inch double seamers
- One pair $1\frac{1}{2}$ -inch double seamers

One pair of adjustable pin flanging tongs will take the place of the two pairs of fixed flanging tongs listed above. However, the double seamers are the tools that cost the most.

Considering the cost of the special tools, the time required to roof a building with this type of Double Standing Seam Roll roofing, the difficulty of turning two thicknesses of metal and the cost of, and lack of familiarity with the special tools, it is recommended that this roofing be applied by an experienced sheet metal contractor.

Flashing for Roll Roofing

For information concerning the proper flashing to use with Roll roofing, please see Chapter VI entitled, "Galvanized Steel Flashing."



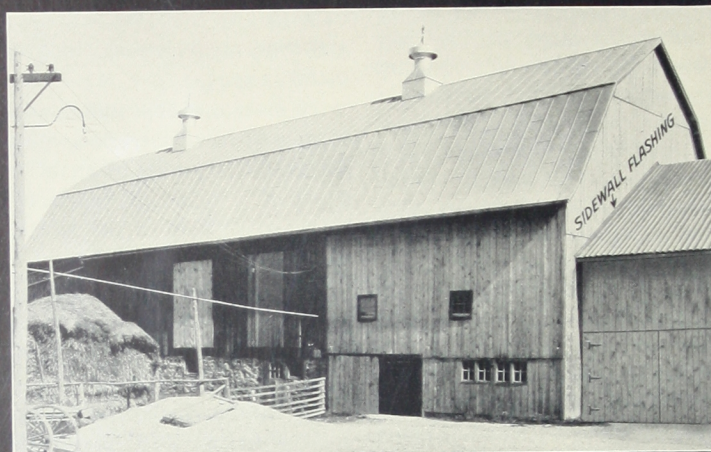


Fig. 1. Where Corrugated Side-wall Flashing should be used.

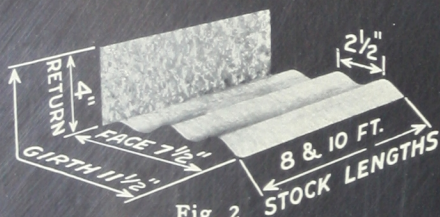


Fig. 2
Corrugated Side-wall Flashing

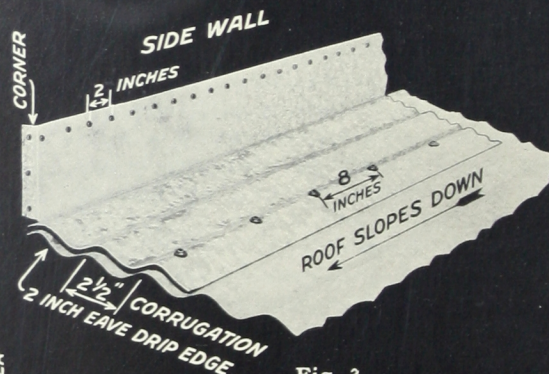


Fig. 3
Close-up view of application of
Corrugated Side-wall Flashing



Fig. 5
Close-up view of application of Corrugated
End-wall Flashing

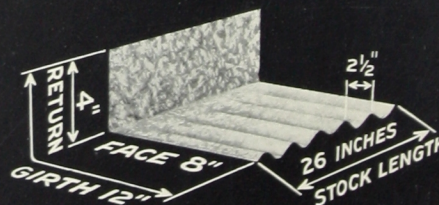


Fig. 4
Corrugated End-wall Flashing

Galvanized Steel Flashing

Sheet Steel for Roof Flashing



FLASHING consists of bent pieces of sheet steel which are placed over a joint between the roof and a vertical wall, chimney or other projection for the purpose of making the joint water-tight. One leg of this flashing fits closely to and on the roof while the other leg fits tightly against or into the wall, chimney or other portion of the building being flashed. When the side-wall construction consists of vertical courses of siding, such as is shown on the barn in Fig. 1, page 76, the flashing is used in long units, the top edges of which run parallel to the roof slope. When, on the other hand, the side-wall construction consists of horizontal courses, like weather board siding as shown in Fig. 1, page 78, or brick, the flashing is used in smaller units, the top edges of which are finished parallel with the various horizontal courses of the siding. This results in a stepped effect as is clearly shown in Fig. 5, page 78.

There are many kinds of flashing but it is necessary to describe only a few in this book.

Base Flashing

Take the case of a Corrugated roof butting up against a wood wall, similar to the Corrugated roof on the ridge shed butting up against the wood wall at the end of a Gambrel roofed barn as shown in Fig. 1, page 76.

Figure 2, page 76, shows corrugated side wall flashing for 2½-inch Corrugated roofing. Figure 3, page 76, shows the flashing applied to the roof and wall. The main roofing sheets should fit with their edges tight against the wall and should be fastened along these edges with nails spaced 18 to 24 inches apart. The side wall flashing should be applied, as shown, with three corrugations overlapping the main roofing. The flashing is nailed through the top of the corrugation nearest the edge, spacing the nails 8 inches apart. The nails in the non-corrugated leg of the flashing which lies

up against the wall should be hot-galvanized roofing nails with 1-inch barbed shanks and should be spaced 2 inches apart. This close spacing keeps the metal closer to the wall and prevents water from leaking in back of it. The edge between the metal and the wall should be given a heavy coat of oil paint as further assurance against leaking. The corner shown at the low end of the flat piece shows how to make this return in case a corner exists.

There are instances where the ends rather than the side edges of the corrugated roofing sheets butt up against a wall such as is shown in Fig. 1, page 78, where the porch roof joins the house. Figure 4, page 76, shows corrugated end wall flashing for 2½-inch Corrugated roofing to be used in such cases. Figure 5, page 76, shows the flashing applied to the roof and wall.

The main roofing sheets should fit with their edges 1 inch away from the main wall and should be fastened with about three nails in each sheet. Then the end wall flashing should be applied as shown, with the outside edge bent down to form the drip edge and the upper part, called a return, bent around the corner. The corrugated part is nailed through the top of every second corrugation the same as with the eave drip edge. Use lead washers on the nails. The flat part against the wall is nailed every 2 inches as in the case of side wall flashing, and the top edge against the wall should be well painted. If possible it is best to insert this top edge into a joint between two pieces of siding.

Counterflashing or Cap Flashing

Counterflashing, commonly called "cap flashing," is another bent piece of steel which has one leg sticking into the wall, mortar joint or wood siding joint and the other leg hanging downward toward the roof. Cap flashing is used over base flashing. If the cap flashing extends a long distance on one level it is called "level" cap flashing, such as is shown in Fig. 3, page 78. If it is in short pieces for



Fig. 1. This Cottage illustrates the use of Corrugated End-wall Flashing and Stepped Side-wall Flashing when Corrugated Roofing is used



Fig. 2. Level Cap Flashing showing the Small Flange which locks it into the Raked Mortar Joint



Fig. 3. Level Cap Flashing applied in Brick Wall

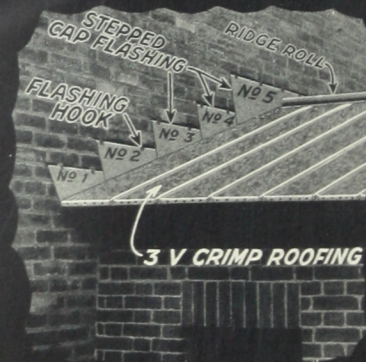


Fig. 5. Stepped Cap Flashing applied in Brick Wall



Fig. 4. Stepped Cap Flashing with Joint Locking Flange

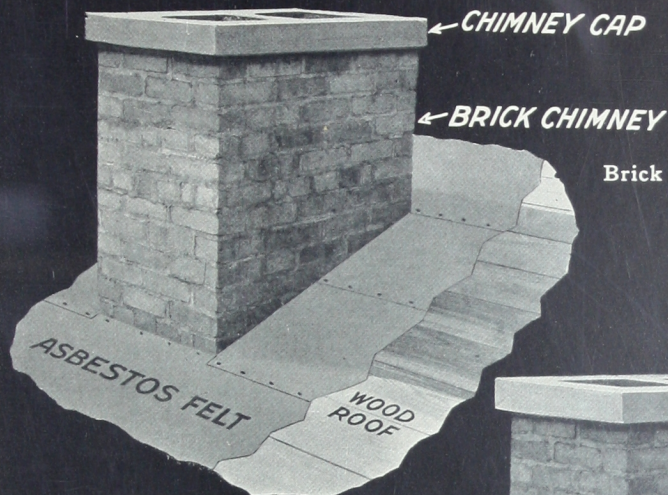


Fig. 1
Brick Chimney ready to be
Flashed

Fig. 2
Application of Corrugated End-
wall Base Flashing after the
mortar joints have been raked

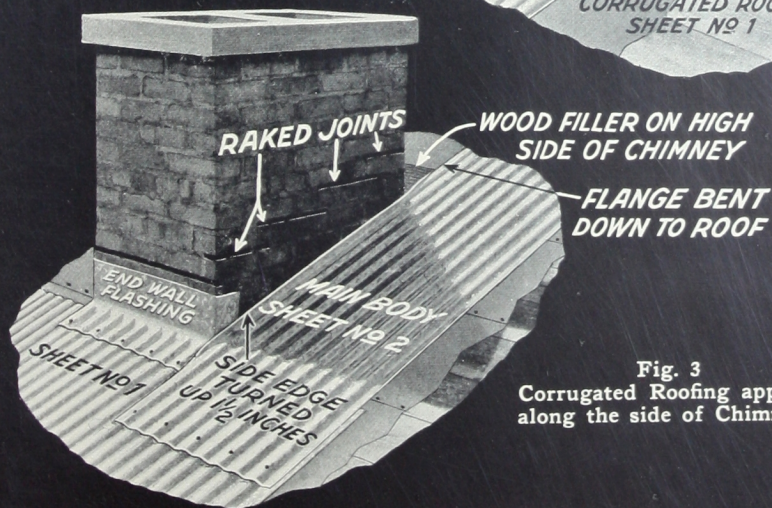
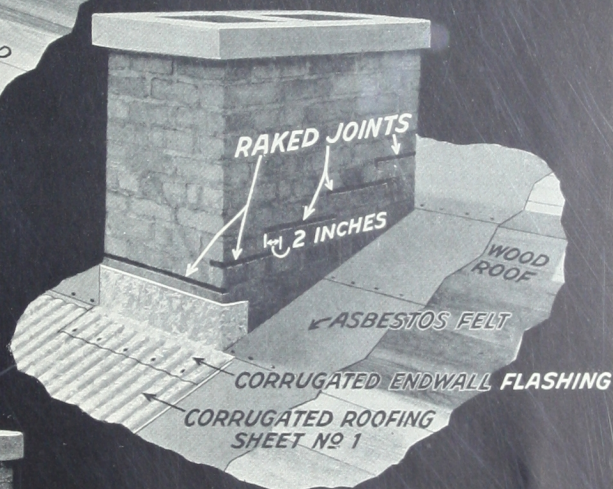


Fig. 3
Corrugated Roofing applied
along the side of Chimney

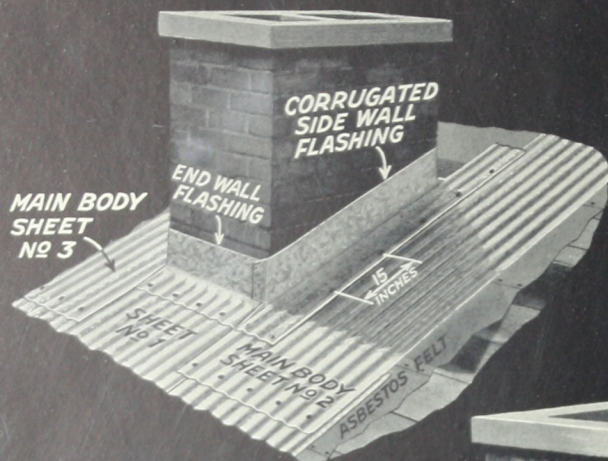


Fig. 1
Application of Corrugated
Side-wall Base Flashing

Fig. 2
Base Flashing applied on up-
per face of Chimney

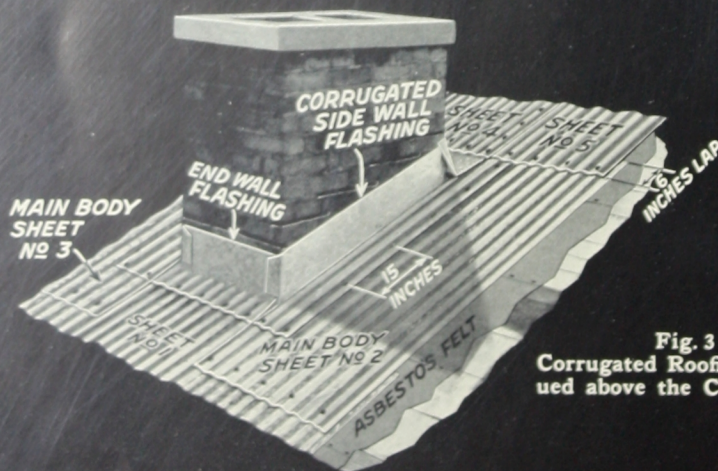
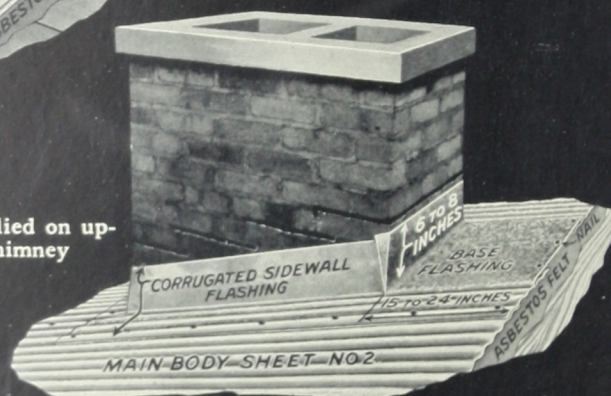


Fig. 3
Corrugated Roofing contin-
ued above the Chimney

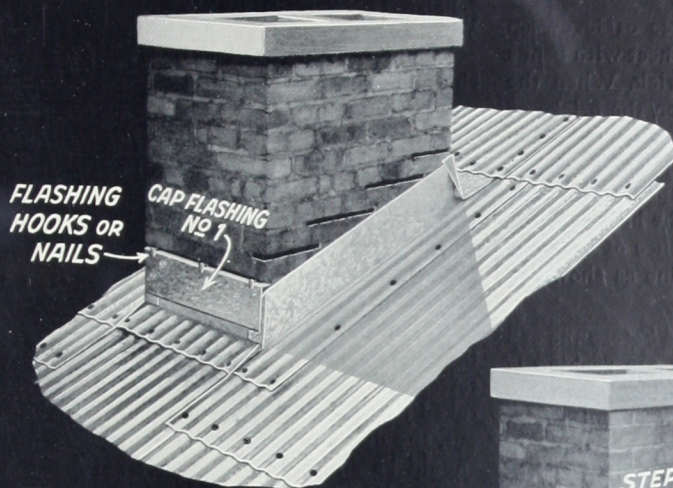


Fig. 1
Level Cap Flashing applied
over Base Flashing on lower
face of Chimney

Fig. 2
Stepped Cap Flashing applied
over Base Flashing on side faces
of Chimney

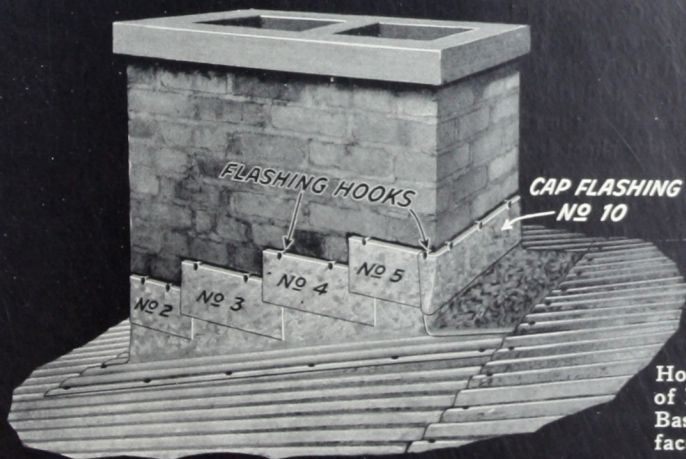
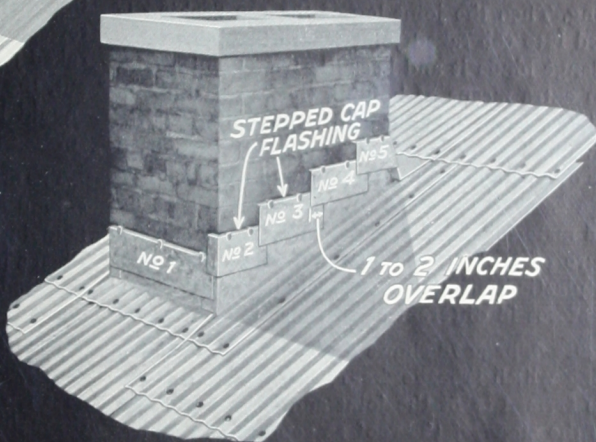


Fig. 3
How to apply the last piece
of Level Cap Flashing over
Base Flashing on upper
face of Chimney

use on a sloping joint it is called "stepped" cap flashing as in Fig. 5, page 78.

Figure 2, page 78, shows a piece of level cap flashing which is made from a flat sheet with bends formed to fit the joints in the brick. When the mortar is chiseled out from between the bricks of the chimney or wall the point is called a "raked joint." The side of the joint locking flange, marked $\frac{1}{4}$ to $\frac{3}{8}$ inch in Fig. 2, page 78, depends upon the depth of the raked mortar joint. The height of the vertical leg depends upon the distance of the mortar joint selected from the roof line as shown in Fig. 3, page 78.

The base flashing must be applied before the cap flashing. Then the joint leg of the cap flashing is pushed into the raked joint where the joint locking flange binds it and keeps it from coming out. As an extra means of holding the cap flashing in this joint, small hook-headed nails, called "flashing hooks," are driven into the joint with hard blows of a hammer. This joint should then be filled with a sand and cement mortar, or with a ready mixed material called "plastic cement," which is a mixture of asphalt, asbestos and other materials. This plastic cement may be bought in the hardware stores in different sized cans.

Figure 4, page 78 shows a piece of stepped cap flashing which is made from a flat sheet with the bends formed to fit the joint and the vertical leg to fit the slope of the roof as conditions require. Where roofing of a type other than Corrugated is used, and where the sides of the sheets, rather than the ends of the sheets, are against the wall to be flashed, it is permissible and often desirable to turn the side edge of the sheet up against the side wall 3 or 4 inches so that the roofing sheet itself serves as the base flashing. The stepped cap flashing is applied in the same manner as described for level cap flashing, except that piece No. 1 is applied first and piece No. 2 second with at least 2 inches end-lap down over the top end of No. 1. Repeat with No. 3, 4 and 5 in order. The joints should then be filled with mortar or plastic cement.

Flashing Around a Chimney

Nearly all chimneys that are built of brick require base flashing and cap flashing to make them water-tight. Usually the steel work is soldered, but construction of the flashing as described here

does not require any soldered joints. It makes a water-tight job that should remain in good condition for the life of the roofing.

Figure 1, page 79 shows the roof deck around a chimney just as the carpenter would leave the work and before the steel roofing has been applied. Before applying the steel roofing, remove the mortar from between the bricks so as to make the raked joints for the cap flashing. These joints should be about 1 inch deep and are best made with a cold chisel. While location of the raked joints may vary somewhat due to peculiar local conditions, a safe average is the third mortar joint above the roof, as indicated in Fig. 2, page 79. It should be noted that the lower raked joint extends about 2 inches back toward the roof beyond the front end of the next raked joint above. When all raked joints have been cut, the dirt and small pieces of mortar or bricks should be swept from the roof so that the deck surface is clean.

The main body sheet of Corrugated roofing should extend up to the low face of the chimney and be held in place with two nails near the top edge. Then a piece of corrugated end wall flashing should be fitted over the roofing so as to extend at least one full corrugation on each side of the brick work. The vertical leg of the flashing should be cut to fit the slope of the roof when bent round the corner as shown in Fig. 2, page 79. Nails are driven through the tops of the corrugations in the corrugated leg of this flashing. No nails are needed in the vertical leg.

The main body sheets, Nos. 2 and 3, along the sides of the chimney are next fitted into place as shown in Fig. 3, page 79, particular attention being given to the side edge which is turned up $1\frac{1}{2}$ inches and fits snugly against the brick work. The lower end of this upturned edge or flange is cut off along the bottom of the corrugation so as to fit closely to sheet No. 1. The portion of the flange covering the end wall flashing is cut on the gradual slope from the top of the flange down to the bottom of the corrugation. The upper end of the flange above the upper face of the chimney is not cut off but is flattened down to the roof.

The upper or high side of the chimney will now have a depression or low space between the edges of main body sheets No. 2 and 3, because of the flanges turned up on those sheets. To provide proper drainage, nail in this space, a piece of wood

1½ inches thick by 6 or 8 inches wide having its upper edge cut off or tapered down from 1½ inches to ¾ inch in thickness.

The corrugated side wall flashing is next fitted along the sides of the chimney as shown in Fig. 1, page 80. The lower end extends even with the edge of the corrugated end wall flashing and the vertical leg is cut off and bent around the corner. The upper end extends even with the top edge of sheet No. 2 and the vertical leg is bent around the upper corner of the chimney. This side wall flashing is nailed only along the outside corrugation, spacing the nails about 15 inches apart.

The base flashing at the upper face of the chimney should be made from a flat sheet of galvanized steel, not lighter than No. 26 gauge, with the vertical leg 6 to 8 inches high and the other leg on the roof not less than 15 inches long, as shown in Fig. 2, page 80. This base flashing should be 4 to 6 inches or more longer than the chimney is wide so that the edges of the lower leg can be bent down into the valley of the second corrugation removed from the sides of the chimney. This will carry the rain water away from the sharp corner of the brick work where leaks might otherwise occur unless soldering were resorted to. Nails are driven in the upper edge of the lower leg only. The top ends of the vertical leg are bent around the corner of the chimney.

The main body sheets of roofing, sheets Nos. 4 and 5, are next applied above the chimney in the regular way, as shown in Fig. 3, page 80. They should have at least 6 inches lap down over the flat base flashing.

The counter or cap flashing is applied in the same

general order as the base flashing, namely the low face first, then both sides, and lastly, the high face. The first piece of cap flashing is shown in Fig. 1, page 81. The flange that projects 1 inch into the raked joint has a small flange about ¼ to ⅜ inch high turned up on the back edge, thus helping to bind the steel in the joint between the bricks. The main fastening is made by driving small flashing hooks or nails into the mortar until firm. If heavy nails are used, they should be of the galvanized type.

The cap flashing on the side of the chimney is similar to the bottom face except it is in shorter lengths and one piece is stepped above the other as shown in Fig. 2, page 81. Piece No. 2 is bent around the corner and is fastened first. Piece No. 3 overlaps No. 2 from 1 to 2 inches and is applied second. Then No. 4 is applied the same as No. 3. Piece No. 5 extends around the corner the same way as No. 2 except that it is held away from the sharp brick corner by the bent leg of the base flashing. These pieces are fastened with the flashing hooks or heavy galvanized nails. The other side of the chimney is next flashed in the same way, working from the low face up to the high face with pieces Nos. 6, 7, 8 and 9.

The last piece of cap flashing, piece No. 10, is applied on the high face of the chimney and is bent around both corners to cover pieces Nos. 5 and 9 as shown in Fig. 3, page 81. It is then fastened with the hooks or nails.

Upon completion of the application of the steel work, all raked joints should be filled with a sand and cement mortar, or with a ready mixed material called "plastic cement."



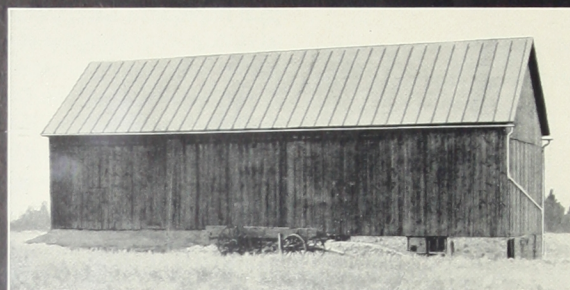


Fig. 1
Eave Trough sloping in one direction to Conductor



Fig. 5
End Cap for Eave Trough

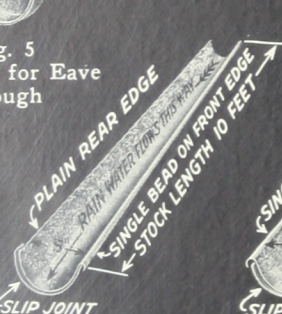


Fig. 2
Single Bead, Slip Joint, Left Hand Eave Trough

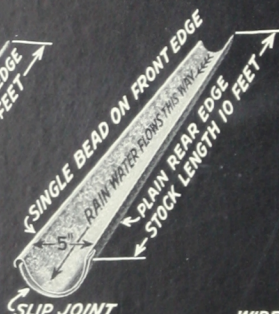


Fig. 3
Single Bead, Slip Joint, Right Hand Eave Trough

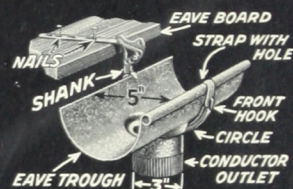


Fig. 4
End Piece and Outlet for Single Bead Eave Trough

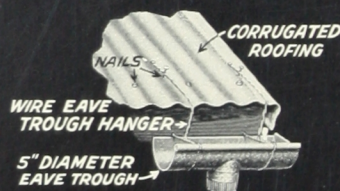


Fig. 6
Wire Hanger applied to Single Bead Eave Trough

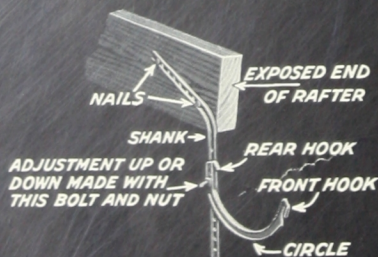


Fig. 7
Shank and Circle to fasten Eave Trough to exposed rafter end

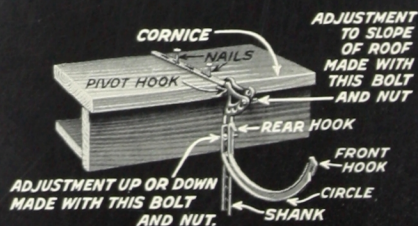


Fig. 8
Shank and Circle to fasten Eave Trough to cornice

Roof Drainage

Drainage of Rain Water

THE life of any building is lengthened if the rain water is carried off the roof and discharged in some desired place rather than being allowed to drip from the full length of the eaves and splash mud on the side walls, discoloring the paint and damaging the siding. The easiest way to control the rain water is to use a hanging gutter, known as galvanized eaves trough, and down spout, usually termed a conductor pipe.

The eaves trough can be erected so that it slopes in one direction only from one end of the eave to the other, as shown in Fig. 1, page 84, or it can be hung high at or near its middle point, and be allowed to slope in opposite directions to the gable ends. Or again the trough may slope from both ends toward the middle, where a conductor outlet can be installed. The trough is held in position by trough hangers. In determining the location of the conductors, however, it is well to avoid the northeast corner of the building in cold climates. Conductors so located are more subject to freezing.

In assembling gutters and conductors two things should be avoided whenever possible. First, conductors should be located at the outside corners, namely at the juncture of hip and eave, rather than at inside corners where, because of the juncture of valley and eave, the flow of water is concentrated. Second, if possible to avoid it, conductors should never be placed at the northeast corners of buildings in the colder climates because of the greater danger of freezing when so located.

Where there is a likelihood of overhanging or nearby trees depositing leaves in the gutters, it is recommended that care be taken to see that the eave drip edge of the roof does not project into the gutter. Since acids contained in slowly running or trickling water are responsible for much damage to gutters, conductors and valleys, it is recommended that such obstruction be removed whenever they are noticed.

Do not expect an eaves trough and conductor pipe of moderate size to drain an extra large roof. Experience shows that 1 sq. in. of conductor pipe will drain 125 sq. ft. of steep roof area or 150 sq. ft. of fairly flat roof area. As most roofs have good slopes the following rule will usually serve as a satisfactory guide:

"Provide one conductor pipe, 3 inches in diameter, for every 90 to 1000 sq. ft. of roof area."

For example, take one side of a ridge barn measuring 65 feet long by 27 feet up each slope from eave to ridge. Multiplying the length by the width, 65 feet x 27 feet, equals 1755 sq. ft. of roof area. Divide 1755 by 900 sq. ft. This goes about twice, which means that two conductor pipes, 3 inches in diameter are required on each side of the barn.

Types of Eaves Trough

There are several styles of galvanized eaves trough, of which the most commonly used size and type is 5 inches wide with a curved front edge and a plain rear edge, and provided with a slip joint. This is termed single bead eaves trough. The double bead type of trough has both the front and rear edges curved and, because of its greater stiffness, is to be preferred. Figure 2, page 84, shows the slip joint end of a left-hand single bead trough and Fig. 3, page 84, a right-hand trough.

Face the building where the trough is to be placed. If the gutter slopes with the high end on the left and with the slip-joint on the low end to the right so as to discharge the rain water to the right, a right-hand trough is required. If the water flows to the left, a left-hand trough is required. Unless ordered otherwise, the same amount of both right-hand and left-hand trough is shipped. The stock length is 10 feet.

The end of a section of trough opposite the slip-joint end is made perfectly smooth so that it can be inserted easily into the slip joint of the next

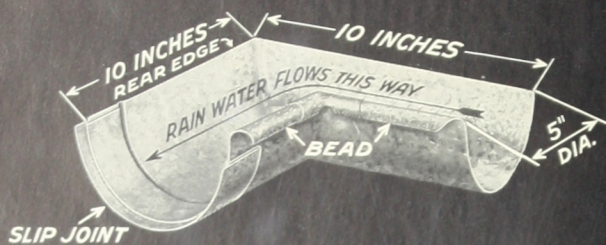


Fig. 1
Left-hand inside corner



Fig. 2
Right-hand inside corner

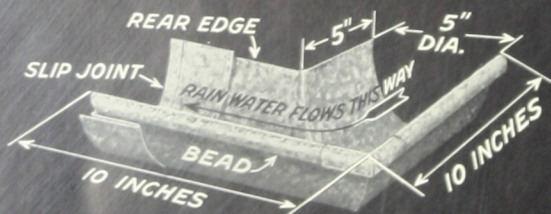


Fig. 3
Left-hand outside corner

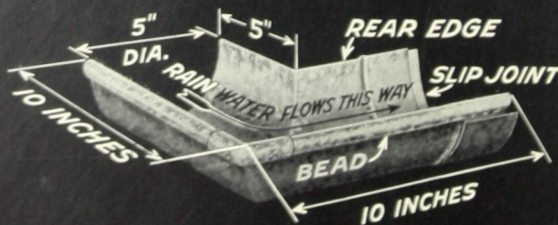


Fig. 4
Right-hand outside corner

EAVE TROUGH MITERS
(Single Bead, Slip Joint)

piece to follow. No solder is necessary to make a tight joint. In erecting this trough, just be sure the two ends are pushed tightly together and there will be no leaking.

Figure 4, page 84, shows the short section of a 5-inch single bead eaves trough equipped with a connection for the conductor pipe. The common trade name for this piece, which is factory-made, is an "end piece with outlet." The common size is a 5-inch trough and 3-inch outlet. Figure 5, page 84, also shows the factory-made "end-cap" which fits tightly to the end of the trough in the position shown. This prevents the rain water from running out the end of the trough. No solder is required on these fittings to make them water-tight.

Eaves Trough Miters

When an eaves trough is continued around a corner or angle of an eave, the joint of these two pieces of trough is called a miter or a miter joint. It would be difficult to join two long pieces of trough in a water-tight miter on the eave of a building without a large amount of preparation and without soldering the joint. This is overcome by the use of factory-made eaves trough miters which have only a short portion of the trough on each side of the joint. A miter may be made to fit any angle, but the only factory-made miters carried in stock are for 90 degree angles or square corners. These are called "Square Return Miters."

Miters which are made from two pieces of trough are called "Two Piece Miters." Some manufacturers make miters from only one piece of steel and hence these are called "One Piece Eaves Trough Miters."

The two edges forming the miter joint are interlocked so that they make a firm joint water-tight and smooth on the inside of the trough to permit free flow of water. These miters are usually dipped into hot galvanizing after they are formed so as to thoroughly seal all edges and provide a uniform coating to the body of the metal.

When a miter is made to be used on the outside corner of an eave, it is called an "Outside Corner Miter." When made to be used on an inside corner of an eave it is called an "Inside Corner Miter."

The style of eaves trough used determines the style of miter that must be used with that trough. Hence, if a single bead, slip joint eaves trough is used, the miter should correspond by being a single bead, slip joint miter. The size is usually 5 inches

in diameter which corresponds to the 5-inch eaves trough so universally used.

Just as each glove of a pair of gloves has four fingers and one thumb, one fitting only the right hand and the other the left, so are there right-hand and left-hand miters for eaves troughs. It is quite easy to determine which is which by the following rule:

"When facing the corner of the building or miter, and having the single bead edge closer to you, if the slip joint is on the right, it is a right-hand miter. If the slip joint is on the left, it is a left-hand miter."

For example, Fig. 1, page 86, shows a miter with the bead closer to the reader and with the slip joint on the left; hence this is a left-hand, inside corner miter in which the rain water flows from the right towards the left. Again in Fig. 2, page 86, the bead is closer to the reader but the slip joint is on the right-hand side, hence this is a right-hand, inside corner miter. It should be noted in these two fittings that the corner of the bead is away from the reader and that the two ends of the beads come towards the reader. This fact determines these fittings for inside corners.

The fitting in Fig. 3, page 86, has the bead towards the reader and the slip joint on the left-hand side, which makes this a left-hand miter, but because the corner of the bead is closer to the reader with the two ends of the beads farther removed this miter is for an outside corner. Hence, this is a left-hand, outside corner miter.

Similarly, since the fitting in Fig. 4, page 86, has both the bead and its corner closer to the reader and the slip joint on the right, it is a right-hand, outside corner miter. Figures 1 and 2, page 86, are inside corner miters, one left-hand and the other right-hand.

If when fitting a run of eaves trough to miters, it is found necessary to cut a length of eaves trough, it should be remembered that the slip joint end of that length being cut should be preserved while the opposite or single thickness end should be cut as waste, or to be used later. In other words, if the closing piece of eaves-trough measures 8 ft. 9 ins., which includes the amount to go into the slip joint of the miter or end cap, then this 8 ft. 9 ins. should be measured from the slip joint end of the 10-foot stock length of eaves trough so that the 1 ft. 3 ins. waste piece is perfectly plain on both ends.



Fig. 1
Installation of Eave Trough and Conductor.
Note the use of Cut-off for storage of soft rain water.

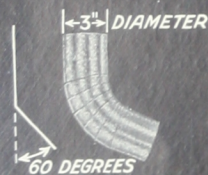


Fig. 2
Corrugated
Round Elbow
(3-inch diameter,
60 degree)

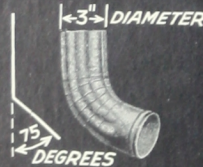


Fig. 3
Corrugated
Round Shoe
(3-inch diameter,
75 degree)



Fig. 4
Hinged hook to fasten
a 3-inch corrugated
round conductor pipe
to wood wall



Fig. 5
Hinged hook opened to
drive the shank into
wood wall



Fig. 6
Cut-off for 3-inch corrugated
round conductor pipe

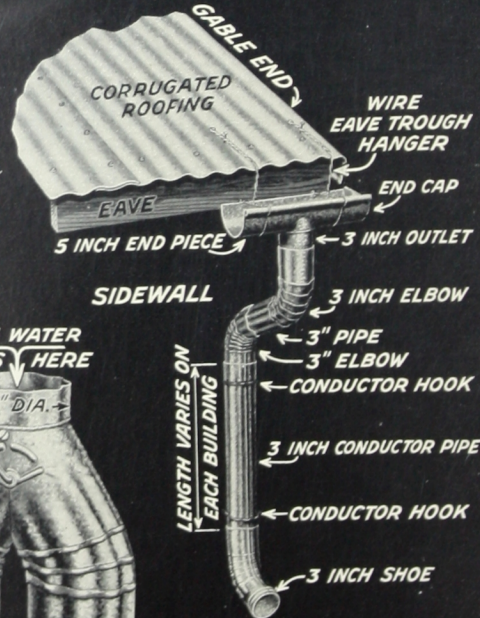


Fig. 7
Conductor Pipe
and Fittings
assembled

Types of Eaves Trough Hangers

There are several styles of eaves trough hangers but the most commonly used is the triple wire, single bead eaves trough hanger, made from galvanized steel wire. Fig. 6, page 84, shows the wire hangers fitted to the end outlet piece of the eaves trough. The vertical twisted wires form the shank, which is provided with one nail hole at the extreme upper end and another about $1\frac{1}{2}$ inches below it. Wire hangers usually are shipped in equal numbers of 7-inch long shanks for the high end and 9-inch long shanks for the low end.

The shanks are readily bent so that in hanging the eaves trough you can provide for a uniform fall or slope toward the conductor outlet. These hangers usually are nailed on top of the finished roofing. If nailed on the eave before the roofing is applied it is more difficult to replace or readjust them. The hangers should be spaced about $2\frac{1}{2}$ feet apart. Extra ones may be used where especially needed.

Another type of eaves trough hanger is made of malleable iron and is heavily coated with tin. Fig. 7, page 84, shows a malleable rafter iron shank and circle designed for use where the rafter end is exposed. These shanks come in three stock sizes, the shortest about 3 inches long, the medium about 4 inches long and the longest about 6 inches long. The usual job requires about the same number of each length. The shank is nailed to the side of the rafter in such a position that the hanging stem is vertical. The circle is adjustable.

This circle, at the high end of the eaves trough, should be fastened high enough to support the eaves trough level with the drip edge. It is even permissible, where necessary to obtain the proper slope, for the drip edge to hang into the trough just a little, where there are no overhanging trees to clog the trough with fallen leaves. The circle at the low end of the trough should be adjusted low enough on the shank to provide good drainage from one end of the trough to the other. The fall should be at least $\frac{1}{8}$ of an inch to the foot, and preferably steeper. In case the stock sized shank is not long enough to permit the proper slope, extension shanks can be obtained.

Take, for example, a barn 60 feet long. A fall of $\frac{1}{8}$ of an inch per foot ($\frac{1}{8} \times 60$) would equal $7\frac{1}{2}$ inches. Hence, the trough should have $7\frac{1}{2}$ inches total fall. The intermediate circles along the trough should be adjusted up or down so as to

provide a uniform, steady slope, free from humps, from the high end to the low end of the trough. A string stretched tightly from one end of the eave to the other will assist in properly adjusting the circles to the right slope.

Figure 8, page 84, shows a malleable iron hinged hanger which is nailed on top of the eave boards, preferably over the end of the rafters. It can be laid under corrugated roofing and shingles, or on top of any kind of roofing. The hanging stem can be adjusted until it is vertical and two of the several holes come opposite each other to permit inserting a bolt. The circles are adjusted up or down as with the other malleable hangers. Both the hinge and the circle adjust to every $\frac{1}{8}$ inch. This hinged type of hanger is especially valuable where no rafter ends are exposed.

The plain or rear edge of the eaves trough fits under the rear hook of the circle, nearest the hanging shank. The bead or front edge rests on top of the front end of the circle. A small cleat or strap with a hole in one end is hooked over the front circle hook and then bent over the bead edge with the free end projecting into the trough. This cleat should then be pinched together to give a firm hold to the bead edge and prevent the wind from lifting the trough out of the circles.

Conductor Pipe and Fittings

The two types of galvanized conductor pipe most commonly used are "plain" round and "corrugated" round, 2, 3 and 4 inches in diameter, and in stock lengths of 10 feet. Figure 2, page 88, shows a fitting called an "elbow" and Fig. 3, page 88, a finished end called a "shoe."

Elbows are used to change the direction of the pipe. Shoes are used to finish the end from which the rain water is discharged upon the ground or into a water barrel or cistern. Water should never be discharged upon the ground close to the foundation of a building without provision for its rapid drainage away from the structure.

Figure 7, page 88, shows 3-inch round corrugated conductor pipe connected by two elbows to make an offset from the eave to the side of a house. In all instances, of course, the upper end of a piece of pipe must fit outside of the bottom of the next higher piece of pipe. This provides for the natural flow of the water inside the pipe and makes the joints water-tight. No solder is required on any joints if they are fitted together correctly.

In colder climates the 4-inch pipe is less subject to freezing and bursting than the 3-inch pipe.

Elbows must guide the water when direction of the flow is changed and consequently they get more wear and strain than a straight piece of pipe. However, the greatest damage to the entire drainage system does not result from wear, but comes during very light or misty rains when an acid solution, caused by the mixture of water, soot, leaves and other deposits, trickles slowly along the gutter and down through the conductor pipe and fittings. A 60 degree elbow, therefore, is more satisfactory than a 75 degree or 90 degree elbow because it has a greater pitch and will drain more quickly, thus retarding corrosion.

The best way to lengthen the life of gutters, conductors and fittings is to paint the inner surfaces, using the high quality of paint recommended in Chapter VIII. No difficulty will be experienced in painting the inner surfaces of gutters. With conductor pipes and elbows, it is necessary only to pour paint in one end, slightly raised, and slowly turn the pipe as the paint flows toward the lower end.

Elbows and shoes should be made from one piece of coated sheet steel and should be of the quality that are hot-galvanized after forming so as to seal or close all raw edges. They should be of a heavier gauge than the pipe. For instance, No. 26 gauge elbow or shoe should be used with No. 28 gauge pipe. The conductor shoes should be made with reinforced bands on the outside so that the inside of the shoe is perfectly smooth, thus facilitating drainage and providing longer life.

The conductor pipe is held to the building by means of hinged corrugated galvanized malleable iron hooks which are driven into the wood as shown in Figure 4, page 88, and as ready to be applied in Fig. 5, page 88. After the conductor pipe has been fitted into a hook, a galvanized wire tie is wrapped

around the small hook ends as shown in Fig. 4, page 88. Every 10-foot length of conductor pipe should have at least two hooks. An extra one should be placed just under the eave fittings so as to hold them in place more securely.

Figure 6, page 88, shows a corrugated round "cut-off" which is placed in the conductor pipe to turn the soft rain water into a cistern. The single outlet end is placed upward so the conductor pipe fits into this end. One side of the double outlet at the bottom may be connected to a shoe that discharges the dirty water from the roof at the beginning of a rain, on the ground. By turning or pushing the lever handle to the other side, the rain water is discharged through the other outlet into the conductor pipe leading to the cistern. This cut-out is placed at some convenient point so it may easily be reached as is shown in Fig. 1, page 88.

Valley and Hip Drainage

The place of meeting of two slopes of a roof which form an exposed internal angle is called a valley as shown in Fig. 1, page 49. The exposed external angle formed by the meeting of two sloping sides of a roof is called a hip which is the reverse function of a valley.

The water from the two slopes forming a valley meets in this valley and then goes in a common direction downward toward the eave, while the water from the two slopes forming a hip goes in different directions. The hip is usually easy to keep water-tight as it forms a natural water shed by its own construction; the valley is just opposite in that the water from one surface tends to run up and in under the covering on the other surface across the valley. For this reason a valley is harder to make water-tight and, therefore, requires careful workmanship in the application of the roofing.

Detailed description of how to roof a valley is given in Chapters II, III, IV and V.



Barn Ventilators

Barn Ventilators of Steel

BARN ventilators are of various types, but all have the same common features of base, flared body, flue, wind band and conical roof.

Several manufacturers add the extra features of compass points and weather vane. Some few ventilators are designed to be placed on the slope of a roof somewhat removed from the ridge, but the majority are placed astride the ridge as shown in Fig. 1, page 92.

The ventilator should be sufficiently weather-tight to keep out rain or snow in storms, yet be designed to afford perfect ventilation in all kinds of weather. It should be screened so that birds cannot enter to build their nests in it. Sizes of ventilators are designated by the diameter of the flue in inches.

It is recommended that those desiring to install ventilating systems consult with their state agricultural colleges or county agents regarding the number and size of ventilators, their location on the roof and the proper installation and assembly of ducts leading to those ventilators. Each individual barn presents its own peculiar problems and no definite directions can be laid down that will fit all cases.

Since lightning is likely to strike buildings in the line of the heated column of air rising from ventilators, it is important that the ventilators be made of or covered with sheet steel and all parts be in metallic contact with the grounded steel roof.

How to Apply Barn Ventilators

The degree of slope of the two roof surfaces at the ridge must be determined before any attempt is made to erect a ventilator. The easiest way to ascertain this slope accurately is to place a piece of board 2 or 3 feet long against the end of the gable and mark the roof lines on it as shown by the white lines on the vertical board in Fig. 2, page 92. This slope will be used in cutting the two sides of

the ventilator base on the ground before hoisting it up to the ridge.

The base usually is square on top and may have either vertical or flared sides and corners. Figure 3, page 92, shows a flared base, as taken out of the crate, in which the four sides slope outwards so that it is larger at the bottom than at the top. Some bases have four anchor bolts, one in each corner—the one illustrated has only two—which fasten into wood braces under the roof deck. The piece of wood used to measure the slope of the roof can be sawed along the white lines, or the same slope can be laid off on a piece of paper. This pattern is then placed against two opposite ends of the base so that the slope lines come at the bottom corners marked "A" and the point at the ridge is midway between the corners as shown in Fig. 4, page 92. This slope line marked "A-B" on the illustration and its mate on the other side of the ridge are then marked in pencil on the ends of the steel ventilator base. Another line is marked below the line "A-B" to form an end flange of the same size as the side flange, and the steel is then cut and bent as shown. This view in Fig. 4, page 92, shows the flared base cut and flanged ready for application after the roofing is laid, but before the ridge roll is applied.

When the location of the ventilators from either gable end is decided upon as in Fig. 1, page 92, a hole almost as large as the base should be cut through the roofing boards. Do not cut any framing timbers such as ridge timber, rafters, hay fork track or the like.

The slope of the roof may be so steep that it is necessary to exercise the "Safety First" policy by using a platform on the ridge from which to work. This platform, as shown in Fig. 5, page 92, consists of planks laid flat on the roof with a cleat on the under side at the ridge to hold them in place. The uprights are cross-braced securely to prevent the frame from collapsing. The planks on top, making the working platform extend out the same



Fig. 1
Showing location of Ventilators on Ridge of Barn

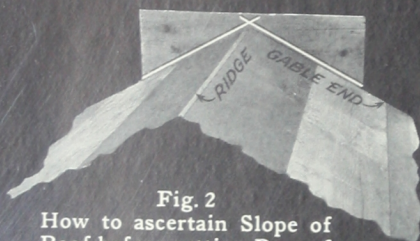


Fig. 2
How to ascertain Slope of
Roof before cutting Base of
Ventilator

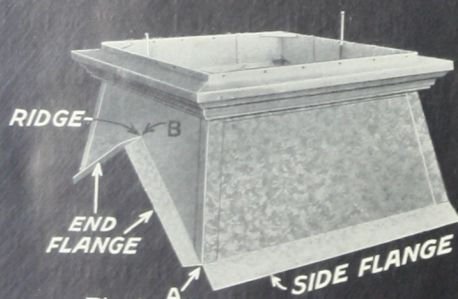


Fig. 4
Flared Base cut and flanged
to fit over Roofing



Fig. 5
Safety-first Platform erected
on Roof

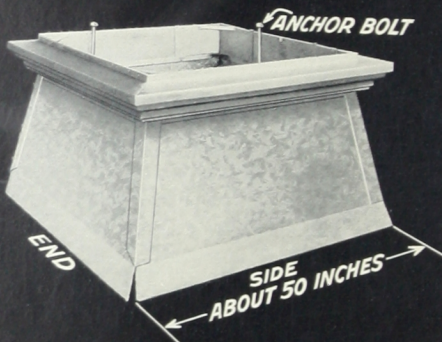


Fig. 3
Flared Base of Ventilator

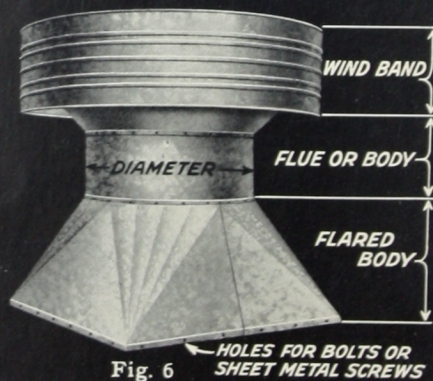


Fig. 6
Ventilator Body assembled
before hoisting to Roof

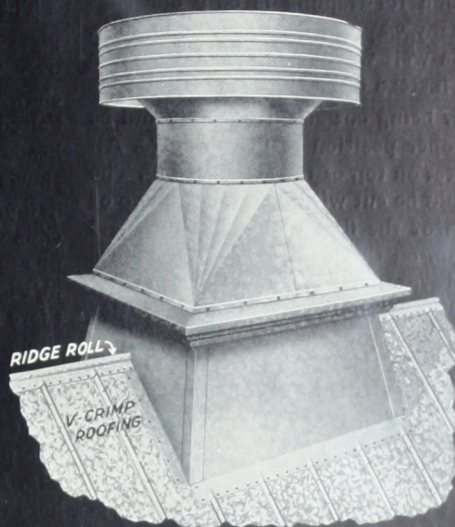


Fig. 1
Ventilator Body assembled on base
applied over 3 V-Crimp Roofing

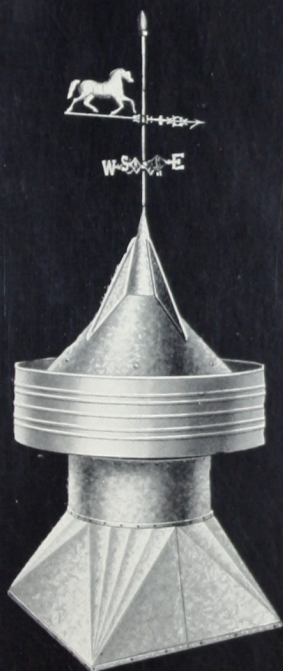


Fig. 3
Top and Body completely assembled

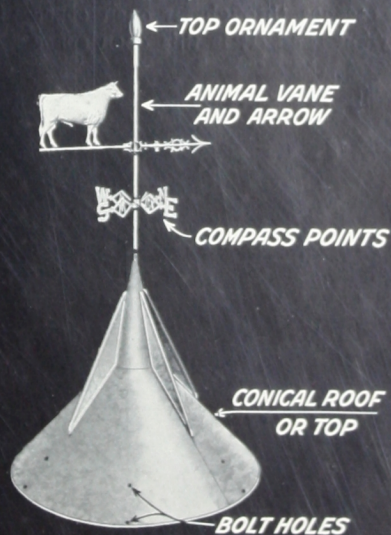


Fig. 2
Top Assembled

distance on each side of the ridge and are nailed to the upright frames on both sides of the ridge. This platform and its framing is only one suggestion of the many ways a platform could be built. In any case it is well worth while to erect some such a platform instead of risking life or limb.

The base, after being cut and flanged, should be placed in its proper position to fit the ridge. All flanges should rest on top of the steel roofing. The roof boards should be cut within an inch or two of the inside edges of the flared base and the steel roofing flanged up on the inside against the sides and ends of the base. Pieces of wood to form what is sometimes called a "short collar beam" or "tie" should be nailed across the rafters near the ridge to act as anchors for the anchor bolts. The base flanges should then be nailed to the roof as shown in the lower part of Fig. 1, page 93, using galvanized nails and lead washers, lead headed nails, or galvanized nails with mushroom-shaped heads.

The assembled body of the ventilator which is usually shipped in one piece so that when uncrated it appears as shown in Fig. 6, page 92, consists of three main parts; the lower part called the flared body, the middle called the flue body, and the top called the wind band. The foul air from inside the barn escapes through an open space underneath the wind band. It is this open space

which should be protected with a wire screen to prevent the entrance of birds.

The assembled body is lifted to the roof and placed so that the flared body fits on top of and over the square flange of the flared base, all as shown in Fig. 1, page 93. The two parts are then bolted together with galvanized stove bolts, with heads outside and the nuts inside. The illustration shows the base applied over 3 V-crimp roofing, together with Ridge Roll which covers the upper ends of the end flanges. The open space over the flue is covered with a conical roof or top as shown in Fig. 2, page 93. Through the center of this top there is a galvanized pipe to which is fastened the compass points, the animal vane and arrow and the top ornament. The lower part of the top has bolt holes which fit with corresponding holes in the braces inside of the wind band so that when these two parts are assembled they appear as shown in Fig. 3, page 93. Galvanized stove bolts are used here with the nuts on the under side. The compass points mate together at the center and are held in position by adjustable rings and set screws. The vane and arrow rest on top of another ring thus allowing the vane to turn with the wind so that the arrow points in the direction from which the wind is blowing. Thus Fig. 2, shows the wind coming from the northeast.

